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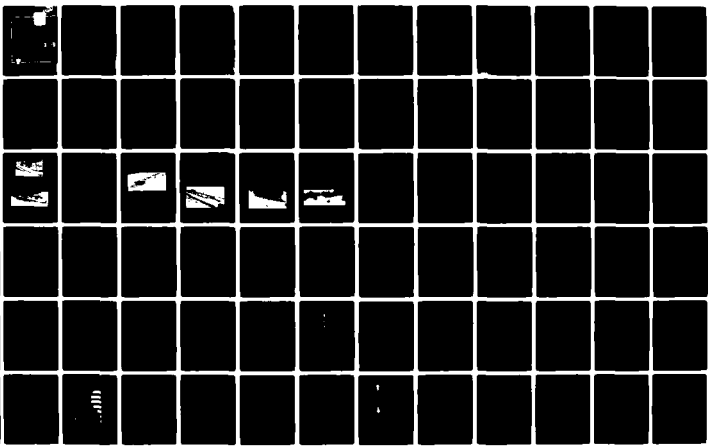
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JUNE 1982

STUDY
PROJECT

MARITIME LOGISTICAL SUPPORT - CAN WE SUSTAIN
OUR ARMED FORCES DURING WAR?

by

CAPTAIN ORA FRANKLIN FRAZE, USCGR
COMMANDER ARTHUR EUGENE HENN, USCG

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-4119692	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Maritime Logistical Support - Can We Sustain Our Armed Forces During War?		5. TYPE OF REPORT & PERIOD COVERED Study Project
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Frank Frazee, Capt. USCGR Gene Henn, CDR, USCGR		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army War College Carlisle Barracks, PA 17013		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Same		12. REPORT DATE 8 June 1982
		13. NUMBER OF PAGES 73
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The basic question is whether or not sufficient merchant ship and crews are available to sustain our forces during war. Both the civilian and military leadership of this nation are focusing more attention on this question. Although as a nation, we generally recognize that the numbers of the US merchant ships and seamen are declining, we don't seem to understand the consequences. This study looks at the consequences of		

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US ARMY WAR COLLEGE
MILITARY STUDIES PROGRAM PAPER

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OUR ARMED FORCES DURING WAR?

BY

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AUTHOR(S): Frank Frazee, CAPT, USCGR
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TITLE: Maritime Logistical Support -- Can We Sustain Our
Armed Forces During War?

FORMAT: Group Study Project

DATE: 8 June 1982 PAGES: 73 CLASSIFICATION: Unclassified

The basic question is whether or not sufficient merchant ships and crews are available to sustain our forces during war. Both the civilian and military leadership of this nation are focusing more attention on this question. Although as a nation, we generally recognize that the numbers of US merchant ships and seamen are declining, we don't seem to understand the consequences. This study looks at the consequences of the United States having to sustain our armed forces in a credible wartime scenario. Background information, insights and data were gathered from a literature search, visits, and personal interviews with maritime officials. The individual programs of various agencies and organizations intended to provide this nation with an effective merchant marine are laudable. However, it is disconcerting to observe the failure of this nation to set forth a national maritime policy that provides a capstone for all the individual programs. It is concluded that we do not have sufficient numbers of several ship-types to sustain our armed forces in a war. Although sufficient seamen are available today, this will not be the case at the end of this decade. The United States should take the following actions: in the near term, acquire merchant ships of those types that we need to sustain our armed forces in credible wartime scenarios; in the long-term, set forth a maritime policy that ensures an effective merchant marine, target peacetime world-shipping markets that employ the ship-types we need in wartime, subsidize as necessary the construction and operation of US merchant ships to acquire and retain these markets, and promote greater understanding and cooperation between the military and civilian leadership concerning our maritime assets.

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CHAPTER I

INTRODUCTION

Volumes have been written about sealift and the capability of the United States to provide adequate maritime logistical support to our armed forces in the event of war or national emergency. Much of what has been written is classified and not readily available to the casual reader.

Purpose

This study attempts to deal with the adequacy of sealift from the point of view of assets - men and ships - and their actual or real condition. For example, do we have enough qualified seafarers to man the ships? What is their condition (age, etc. . .) and would they respond in sufficient numbers? What is the actual condition of the ships themselves? Are they the right types and are they available in adequate quantities?

In an unclassified mode, this study looks at the maritime logistical support available to the United States and attempts to answer the question: "Can we sustain our armed forces during war?"

US Merchant Marine

In the event of a national emergency or any situation requiring mobilization, the United States will have to depend upon the US Merchant

Marine to provide the ships and crews with which to respond. Section 101 of the Merchant Marine Act of 1936 mandates that the United States possess a merchant marine which is "... capable of serving as a naval and military auxiliary in time of war or national emergency "

How functional is that capability today?

A Congressional Research Service report dated May 19, 1981, entitled "US Flag Merchant Marine, Sealift Acquisition Policy and National Security" highlights the necessity of having adequate reserve fleet assets in such a condition that they can support increased sealift requirements in the event of a national emergency. The report states "... that one of the reasons the United States does not have ... adequate sealift capability is because the United States does not have an integrated maritime policy."(1)

The Navy's Chief of Naval Operations has said "without adequate and reliable sealift, literally none of our military plans are executable. More than 90 percent of all wartime cargo will go by sea - mostly in merchant bottoms - regardless of where the conflict is."(2)

Sources Of Ships

The ships required will be obtained from many sources, primarily drawn from programs designed to ensure that the assets will be available when they are needed. It is generally assumed that sealift will be available from the Military Sealift Command (MSC), the National Defense Reserve Fleet (NDRF), the US Merchant Marine, and NATO allies. (3)

Various programs (such as the SRP, the VTA, etc. . .) have been instituted in an effort to ensure that vessels will be made available in the event they are needed.

Military Sealift Command

The Navy's Military Sealift Command is the immediate-response sea transportation force within the Department of Defense (DOD) and is charged with providing immediate and expanded sealift assets to support the needs of DOD. MSC provides auxiliary ships for the Navy, scientific research and survey ships, and specialized vessels to support other government programs such as the strategic petroleum reserve. The MSC relies almost entirely on the civilian work force as a source of mariners in peacetime as well as in time of emergency.(4)

The total MSC controlled fleet as of 2 April 1982 consisted of 142 vessels, including one vessel from the Ready Reserve Fleet operated under General Agency Agreement (GAA) in support of Gallant Eagle '82, and 141 vessels divided into two fleets: (a) the Nucleus Fleet of 83 ships, 59 ships with civil service crews and 24 ships operated under contract, and (b) the commercial fleet with 58 chartered ships, of which 3 are foreign flag vessels, provided by private operators and manned primarily by union crews.(5)

Near-Term Prepositioned Ships

Part of the MSC fleet supports the Rapid Deployment Force. MSC's Near-Term Pre-positioned Force (NTPF) on station at Diego Garcia consists of three RO-RO's, three C-4 general cargo ships, two C-8 lash ships, one water tankship and four petroleum tankships, and two harbor tugs for a total of 15 vessels which are fully operational, manned and ready to sail on an immediate basis.(6) These ships are all US merchant ships under charter to MSC and manned by civilian crews.(7)

National Defense Reserve Fleet

If a contingency requires more sealift assets than are then available from the MSC fleets, the Navy Logistics Plans Division (OP-40) can make a request to the Maritime Administration (MARAD) to activate ships from the Ready Reserve Fleet component of the NDRF and then initiate phased reactivation of ships from the NDRF.(8) As the vessels are withdrawn from the reserve (as per DOD's request), they are assigned to MSC, and are operated by private ship operators under General Agency Agreements (GAAs) to carry the DOD cargos. The private operators oversee repairs, provide crews and stores, and generally maintain the vessels in operative status. MARAD reimburses the ship operators for all expenses plus pays a fixed fee for the service.(9)

The National Defense Reserve Fleet (NDRF) was created by the Merchant Ship Sales Act of 1946 and is composed of surplus vessels considered to be of value if national emergencies, requiring sealift assets, should arise. This act vested responsibility for preserving and maintaining these vessels in the US Maritime Commission; a responsibility now held by MARAD in the US Department of Transportation. The present NDRF is composed of World War II surplus vessels (Victory ships) and miscellaneous ships which have been traded-in to the government by subsidized operators as a credit to offset the cost of constructing new ships.(10)

The NDRF is the only source of reserve dry cargo, break-bulk shipping capacity that the US can be sure of to support a crisis. At the present time there are three NDRF locations at James River, Virginia; Beaumont, Texas; and Suisun Bay, California containing a total

of 188 ships (not including the RRF component) of which 129 vessels are Victory ships (one additional Victory ship is maintained in the RRF).(11) The last activation of the NDRF was in 1965 to support the Vietnam conflict. The importance of this resource is shown by the fact that 40 percent of the material moved to Vietnam in 1967 was transported by NDRF ships.(12)

NDRF ships are preserved and maintained on a continuing program by MARAD. Vessels on the present active retention list are preserved either by the older method of contact preservation or the present (newer) method of dehumidification. We inspected ships in the James River Fleet which have been preserved by both methods and both methods appear to be quite effective. The dehumidification method is more conducive to rapid reactivation however. This method of preservation involves the sealing of portions of the vessel and maintaining the relative humidity in those spaces at about 35 to 40 percent. This atmosphere prevents corrosion and deterioration of the equipment located in the protected spaces. It is anticipated that vessels will be activated from the NDRF over a 60-day period, provided that shipyards can schedule in the necessary work and provided that sufficient merchant seamen will be available to provide the crews.(13)

While the NDRF ships are preserved in an overall excellent condition it must be remembered that the machinery and plant on board is becoming obsolete and will be less and less familiar to those seamen available to operate them. The average age of the ships in the NDRF is about 36 years even though the average ship operational age is about seven years.

Ready Reserve Fleet

To ensure that some ships would be ready to load in a much shorter time a portion of the NDRF was designated as the Ready Reserve Fleet (RRF) under a joint program sponsored by the Departments of Defense and Commerce (MARAD, now in the Department of Transportation). Vessels in the RRF can be made available with five to ten days notice to satisfy immediate needs for emergency supplemental shipping. As of April 2, 1982, there are a total of 28 vessels in the RRF and six of these are maintained on a one to five day readiness program.(14) All RRF vessels are preserved by the dehumidification method and can be made ready to sail without going into a dry-dock period first.

The NDRF and its more ready component, the RRF, represents the only true "Reserve" sealift assets available to the military planner. Other vessels to support defense requirements must come directly from the US Merchant Marine - most of which is already engaged in trade. To provide for the transfer of US flag ships from commercial service when required, many programs have been developed, including subsidy programs to ensure that ships will continue to be built.

US Merchant Ships

Charter of private vessels, including foreign flag ships, is the primary means of obtaining ships in time of crisis. Additionally, in a wartime situation, the US Government can directly requisition privately owned US ships. These programs, which are being relied upon to produce additional sealift assets, are discussed in more detail later in this section.

Recent Congressional Hearings indicate that,

"... as of 1 March 1981, the US Merchant Marine, including those ships covered under SRP, numbered some 533 active merchant ships, of all types of which about 236 dry cargo ships

and 159 tankships are considered useful for military sealift."(15)

Sealift Readiness Program

The Sealift Readiness Program (SRP) is a formal agreement between US flag commercial shipping companies and MSC to enable ships to be acquired by DOD without a formal declaration of national emergency. Operators who have received subsidy assistance, either an Operating Differential Subsidy (ODS) and/or a Construction Differential Subsidy (CDS), must make ships available under the SRP as must those non-subsidized operators who wish to transport peacetime cargo to US military forces overseas for DOD.(16) SRP participating carriers agree to provide up to 50 percent of their committed ships for charter by MSC on a phased basis - 20 percent within 10 days, 30 percent within 30 days, and the full 50 percent within 60 days. The charters are for a period of six months to a year.

Before call-ups can be made under the SRP, MSC must determine that available shipping capability is insufficient to meet requirements and the Secretary of Defense must establish that ships from the NDRF cannot be made available in time or in sufficient numbers to meet military requirements. In addition, the Secretary of Transportation must approve the call-up after having determined that the loss of the ships on existing trade will not damage US flag position in the world shipping market.

Because of the restrictions on SRP call-ups, some critics feel the SRP is actually a "non-asset."(17) No ships have ever been obtained under this program and the effect of such a call-up is an unknown in defense planning. Many feel that operators could lose trade to foreign flag carriers permanently as a result of calling SRP ships off their

regularly scheduled service.(18)

Voluntary Tanker Agreement

A program similar to the SRP is the Voluntary Tanker Agreement (VTA) which is sponsored jointly by MARAD and the tanker industry. This program, which is strictly voluntary, provides a vehicle for the DOD (through MARAD) to make emergency requirements known to those carriers participating in the VTA program. Carriers would allocate their own tankships to meet these needs at charter rates which would be set by a third party designated in the agreement. The number of ships which might be made more easily available through this program is questionable and would depend on current commitments of the individual carriers as well as the seriousness of the emergency.(19)

Effective US Control Fleet

Merchant ships owned by US citizens (individuals, companies and/or corporations located in the USA, and indirectly through foreign subsidiary companies and/or corporations) comprise a fleet commonly referred to as the Effective United States Control Fleet (EUSC).(20) These so-called "Flags of Convenience" or "Runaway Flags" vessels are registered in one of many (approximately 20) different countries but most of them are found in the fleets of Panama, Liberia, or Honduras.(21) While theoretically these ships are available to support US requirements when the need arises, US Government control is not as effective and complete as we would like. For example, in 1968 the government of Panama issued a decree allowing ships under its registry to sail to Cuba, North Vietnam, North Korea, and China in direct contradiction to US policy at the time. In addition, there were at least twelve known instances of

refusals by foreign crews to sail US cargo to Vietnam in support of US involvement there during the period of 1965-1968.(22)

Vessel Requisitioning

It is quite possible that in the event these EUSC ships are requisitioned by the US Government the crews will have to be replaced by US merchant seamen or civil service crews. Theoretically, the DOD can obtain ships directly through requisitioning to support sealift requirements in the event of national emergency or when the President proclaims that any emergency of sufficient magnitude exists. Under these conditions, Section 902 of the Merchant Marine Act of 1936 authorizes MARAD to requisition or purchase any ship owned by citizens of the United States.(23) Ships so requisitioned would be drawn from the existing fleet of US flag ships as well as US owned foreign flag ships, except those registered in NATO countries that would not agree to release them.(24)

Any ships so requisitioned would be assigned to the Navy (MSC) and/or be operated by the National Shipping Authority (NSA) which would be activated by MARAD. The NSA was established in March 1951 as a part of MARAD specifically to handle national emergencies. Typically, vessels obtained by the NSA are turned over to a shipping company under a GAA and assigned to the MSC for operations.(25) During the Lebanon Crisis in 1958, the federal government requisitioned two privately-owned US vessels to supplement the fleet chartered in support of that emergency.(26)

NATO Vessels

Finally, in the event of a NATO conflict, our NATO allies have pledged to provide up to 400 ships from a pool of about 600 to increase

sealift capacity to support efforts in Europe.(27) It is presumed that the goodwill of our NATO allies will make these ships available to us. While recent exercises have tested the procedures which will be used in obtaining vessels from our NATO allies, actual call-up of ships has never been attempted.(28)

US Maritime Policy

The foregoing introduction shows that many programs have been devised in an attempt to ensure that sealift assets will be available to support US military operations when required. From this we can see that an effective maritime policy has been lacking in the past. The United States still does not have an effective maritime policy and no relief is in sight.(29) It is in this environment that we will now study our capability to support one specific, but realistic, scenario with the sealift assets that we have available to support the military operations of the United States overseas.

CHAPTER I

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CHAPTER II

SCENARIO

Any study of the numbers of merchant ships and crews needed to sustain our armed forces must be based on a credible scenario. We selected a scenario that is a composite of those developed by two seminar groups of the Class of 1982, US Army War College.(1)(2) In selecting our scenario, we looked for a realistic sequence of events that was developed in an open forum.

As an overview, the scenario is a limited war starting in Southwest Asia and expanding into a general war that includes Europe. The war goes on for 18 months before both NATO and the Warsaw Pact nations seek a political solution. Only conventional weapons are used.

More specifically, at D minus two (note that all times are in weeks) the United States is alerted of the Soviet Union's planned invasion of a nation in Southwest Asia. At the request of the threatened nation, the United States decides to deploy the following armed forces immediately - one airborne division, one air assault division, one infantry division, one armor division, one mechanized infantry division, five air wings, two marine amphibious forces, and three carrier battle groups. In advance of the main forces, special forces are airlifted to the threatened nation and arrive on D day. The Suez Canal is closed at

D -lus eight.

The United States forces, supported by the armed forces of the threatened nation, engage the Soviet forces for six months with a resulting stalemate.

To prevent the shift of United States forces from Europe to Southwest Asia, the Soviet Union and other Warsaw Pact nations open a second front in Europe at D plus 26. The United States is alerted of the planned attack at D plus 22 and immediately deploys the following armed forces to Europe - seven infantry divisions, three armor divisions, two mechanized infantry divisions, one marine amphibious force, thirteen air wings, and four carrier battle groups. The resulting United States armed forces in the European theater are - seven infantry divisions, five armor divisions, four mechanized infantry divisions, one marine amphibious force, thirteen air wings and six carrier battle groups. In conjunction with opening the second front, the Soviet Union attacks United States naval and merchant shipping. Attrition of US and NATO merchant ships to and from Europe is high until D plus 34 when US naval forces substantially reduce the Soviet Union's submarine threat. Attrition of merchant ships to and from Southwest Asia is moderate and remains so for the duration of the conflict.

The scenario concludes at D plus 78, with both sides seeking a political solution.

CHAPTER II

ENDNOTES

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CHAPTER III

MERCHANT SHIPS AND PORTS

Prior to studying the numbers and types of merchant ships required to deploy and sustain US armed forces, it is helpful to look at some characteristics and capabilities of these ships. Also, it is helpful to identify those types best suited for deploying Army units and sustaining the armed forces in general. When referring to armed forces, we include the Air Force, Army, Coast Guard, Marine Corps and Navy. An important point to remember is that ship selection may be dictated by ship availability. If a more desirable ship type is not available, a less desirable ship type must be selected.(1)

Five types of vessels are suited for deploying Army units and sustaining our armed forces. These are roll-on/roll-off ships (RO-RO), containerships, barge carriers, break-bulk ships, and tankships.

RO-RO Ships

As seen in Figure 1, the RO-RO ship is designed for vehicular cargo to be driven or towed on and off the ships by way of stern and side ramps. Internal ramps are used to move vehicles between decks. The ramps permit rapid loading and unloading of vehicles. The ships can also carry aircraft on the top deck and on some of the lower decks. These ships are very effective in deployment of unit equipment or sustaining equipment losses. In addition to being fast ships, normal loading or unloading can be done in 24 continuous hours. The character-

istics of a typical RO-RO are as follows:(2)

Length:	700 ft
Beam:	92 ft
Deadweight:	14,180 Long Tons (LTON)
Draft:	28 ft
Engine:	30,000 Shaft Horsepower (SHP)
Speed:	25 knots
Deck Space:	150,000 sq ft
Liquid Storage:	16,000 gal

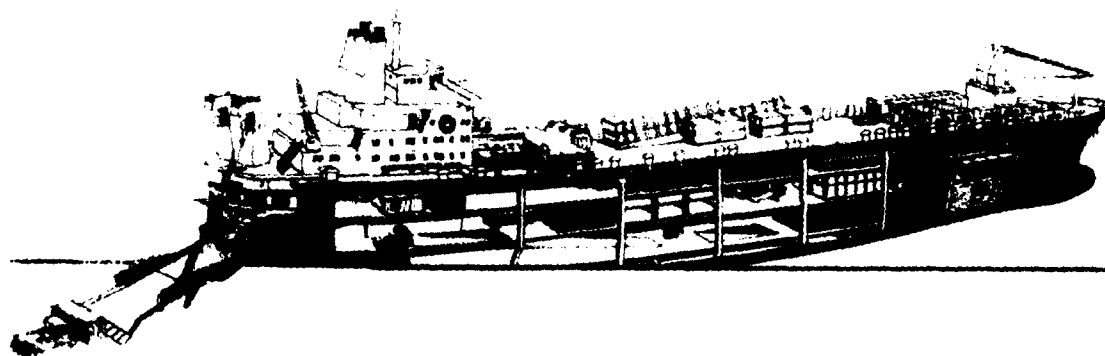


Figure 1
Roll-on/Roll-off (RO-RO) Ship

Containerships

Containerships are designed to transport cargo packed in standard size containers. By combining separate pieces of cargo into a container, the cargo handling time is reduced. Some containerships have cranes that allow the ship's crew to load and unload the containers without using special port facilities. These are known as self-sustaining containerships, Figure 2. On the other hand, the majority of the containerships require special berths equipped with container handling cranes. These are known as non self-sustaining containerships, Figure 3. Containerships are best suited for resupply, such as food and small packaged items. They are not suited for much of an Army division's equipment, such as wheeled and tracked vehicles and nonself-deployable aircraft. For example, an infantry division can containerize only about 32 percent of its equipment, and an armored division can containerize only about 19 percent of its equipment.(3) The characteristics of a typical containership are as follows:(4)

Length:	661 ft
Width:	76 ft
Deadweight:	15,523 LTON
Draft:	29 ft
Engine:	19,200 SHP
Speed:	20 knots
Dry Cargo:	26,175 Measurement Tons (MTON)
Holds:	6

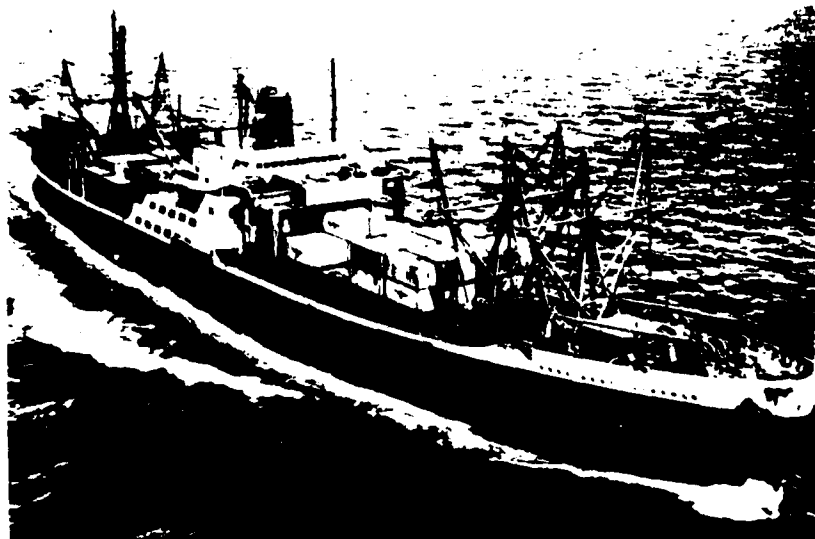


Figure 2
Self-sustaining Containership

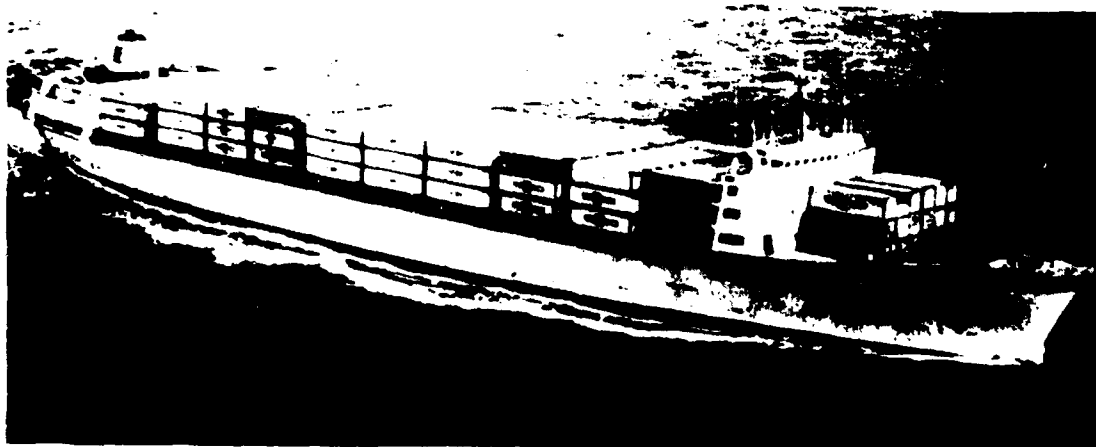


Figure 3
Non Self-sustaining Containership

Barge-Ship Systems

The barge-ship systems have the ability to load and discharge the barges at an offshore anchorage or an established port. Both systems consist of mother ships and families of barges. Both space and shore-side crane support are needed to load and unload cargo from the barges. The barge-ship systems are ideal for transporting military equipment. Their disadvantages are the extensive shoreside crane support required for the barges and the small number of mother ships that have been built. Figure 4 shows the Lighter Aboard Ship system, commonly referred to as the LASH. The LASH ships have a 500-LTON gantry crane to lift the lighters (barges) at the stern of the ship and stow them athwartships throughout the ship. On some LASH ships, a 5-LTON crane is located forward to handle containers. The characteristics of a typical LASH ship are as follows:

Length:	820 ft
Width:	100 ft
Deadweight (Max):	29,820 LTON
Deadweight (Mil Op):	17,800 LTON
Speed (Mil Op):	22.5 knots
Dry Cargo:	37,900 MTON



Figure 4
Lighter Aboard Ship (LASH)

The SEABEE ship can carry all items of equipment used by an Army division. It is the only modern ship that can carry Army helicopters without major disassembly. A unique feature of the SEABEE ship is the 2,000 - LTON capacity submersible stern elevator. The elevator can handle two fully loaded barges simultaneously. Figure 5 shows a SEABEE ship. The characteristics of this type of ship are as follows:(5)

Length:	874 ft
Width:	106 ft
Deadweight (Max):	38,410 LTON
Deadweight (Mil Op):	18,300 LTON
Speed (Mil Op):	21.7 knots
Dry Cargo:	44,350 MTON

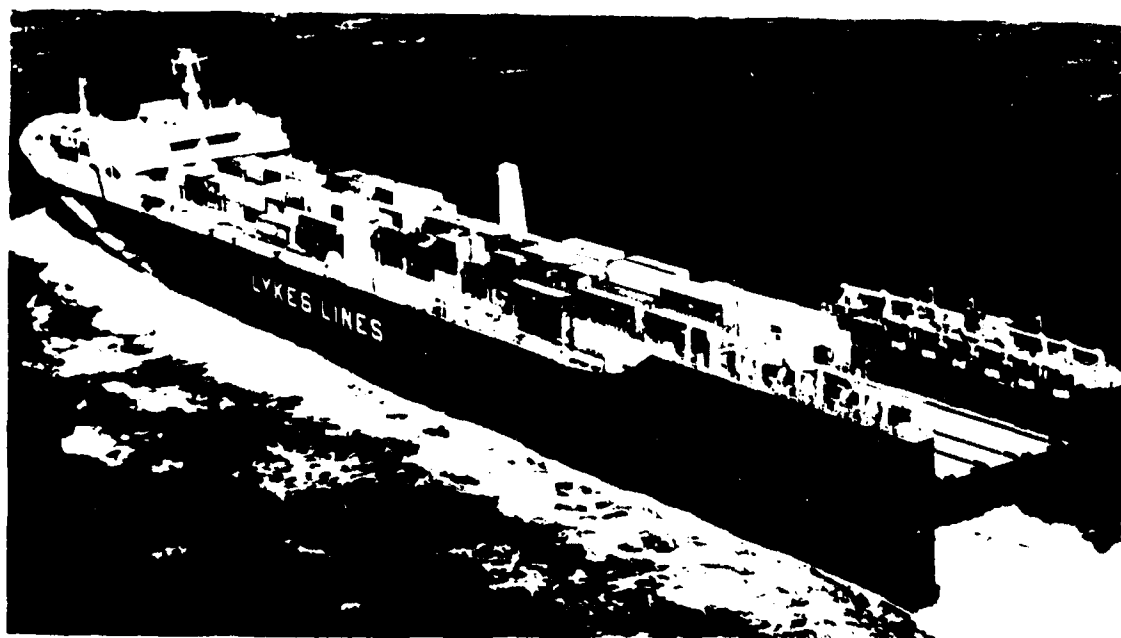


Figure 5
Sea Barge Ship (SEABEE)

Break-Bulk Ships

Break-bulk ships are flexible. They have holds in which individual pieces of cargo are separately stowed, including pallets or outsized, heavyweight vehicles. The ships are equipped with their own booms and winches to lift and place cargo. Figure 6 shows one of the types of break-bulk ships. Loading and unloading can take as long as four 16-hour days because each piece of cargo must be handled separately. Many of the break-bulk ships in the US merchant marine are old and their number is declining each year. The characteristics of a typical break-bulk ship are as follows:(6)

Length:	564 ft
Width:	76 ft
Deadweight:	13,498 LTON
Draft:	30 ft
Engine:	17,500 SHP
Speed:	20 knots
Dry Cargo:	18,400 MTON
Holds:	7



Figure 6

Break-bulk Ship

Tankship

As seen in Figure 7, the tankship is designed to carry crude oil and petroleum products efficiently. Thousands of barrels of oil can be pumped to or from the ship's tanks in a few hours. The trend since World War II has been to build tankships with greater and greater capacity. Today the very large tankships for carrying crude oil have capacities exceeding 250,000 DWT. Tankships are particularly important to the armed forces. However, the tankships needed for support of the armed forces have capacities ranging from 30,000 to 90,000 DWT. Typical characteristics of such tankships are:(7)

Length:	700 ft
Beam:	100 ft
Deadweight:	40,000 LTON
Draft:	36 ft
Engine:	17,000 SHP
Speed:	18 knots



Figure 7

Tankship

Ports

Sufficient ports and berths are available in the United States to handle the ships required for both deployment and sustainment, including the non-self-sustaining containerships. Peacetime requirements provide excess wartime capacity.(8) This is true for Europe also. However, the number of ports and berths in the Southwest Asia theater are probably inadequate. As a result, we used a one week ship turn around time for the United States and Europe and a two week turn around time for Southwest Asia. Table III-1 shows the voyage time one-way based upon whether a ship is fast or slow:

TABLE III-1

Voyage Time One-way in Weeks for Fast and Slow Ships

Destination	FAST SHIP (>20 kts)	SLOW SHIP (<20 kts)
Southwest Asia (Suez Canal Open)	3	5
Southwest Asia (Suez Canal Closed)	4	6
Europe	1	2

Only self-sustaining containerships were used to deploy and sustain US armed forces in Southwest Asia because of the limited port facilities that are vulnerable to sabotage. Nonself-sustaining containerships were used in the European theater because of the numerous developed port facilities and the limited number of self-sustaining containerships.

CHAPTER III

ENDNOTES

1. Jason D. Carroll, MAJ, "Ships and Strategic Deployment," Army Logistician, July-August 1981, p. 2.
2. US Army War College, Military Sealift, p. 18.
3. Carroll, p. 5.
4. US Army War College, Military Sealift, p. 21.
5. Ibid., p. 15.
6. Ibid., p. 18.
7. US Department of Commerce, Ships of America's Merchant Fleet, p. 14.
8. Military Traffic Management Command, Logistics Handbook for Strategic Mobility Planning, pp. 46-49.

CHAPTER IV

MERCHANT SHIPS REQUIRED

In determining the number of ships required, we looked at the three phases in our scenario. These phases are: deploying US armed forces to Southwest Asia, deploying US armed forces to Europe, and sustaining US armed forces in Southwest Asia and Europe simultaneously.

Deployment

Several methods are currently used to determine the number of ships required to deploy armed forces and then sustain them with resupply, ammunition and POL. For example, some logisticians prefer to match up square feet of equipment with square feet of stowage space on a ship. This has considerable validity when stowing vehicles on a roll-on/roll-off (RO-RO) vessel. Other logisticians prefer to deal with measurement tons (MTON), where 40 cubic feet of stowage space is assumed to be equivalent to one ton of weight. Measurement tons are reasonably accurate for break-bulk ships. Others prefer to match the short tons of cargo with the deadweight of a ship. The deadweight is a measure of a ship's cargo carrying capacity expressed in long tons. (Note: Long tons can be converted to short tons by multiplying by 1.12). The advantage of using short tons to determine the number of ships required is that the type of cargo and the type of ship become less important. Hence, a mix of ship-types causes fewer planning problems. One disadvantage is

that military cargos seldom are dense enough to make full use of a ship's deadweight. We elected to use short tons for the purpose of this study.

Extensive studies have been made of the ideal mix of ship-types to deploy various Army divisions.(1) The studies have been supported by several REFORGER exercises. Table IV-1 shows the ideal mix of ship-types for such deployments.(2) An inherent assumption is that Army personnel will be deployed by airlift, therefore no troopships are shown.

TABLE IV-1

Ideal Mix of Ship-Types for Various Types of US Army Divisions

Type Army Division	Number of Ships by Type					Total Ships Per Division
	RO-RO	Container	LASH	SEABEE	Break-bulk	
Airborne	10	5	6	0	3	24
Air assault	10	5	5	4	3	27
Infantry	10	5	5	4	3	27
Armored	12	5	8	3	4	32
Mechanized Infantry	11	5	8	3	4	31

As seen from Table IV-1, the armored and mechanized divisions require the largest number of ships. For all the divisions, the preference is for RO-RO ships and barge - ship systems. Only limited numbers of containerships and break-bulk ships are included in the ideal mix of ship-types.

Recalling that our scenario specifies the deployment of one of each type of Army division to Southwest Asia, the following numbers of ships

are required:

RO-RO	-	53
Container	-	25
LASH	-	32
SEABEE	-	14
Break-bulk	-	17
Total	-	141

Likewise, recalling our scenario specifies the deployment of seven infantry, three armored and two mechanized divisions to Europe, the following numbers of ships are required:

RO-RO	-	128
Container	-	60
LASH	-	75
SEABEE	-	43
Break-bulk	-	41
Total	-	347

Sustainment

To determine the number of ships required to sustain our armed forces, we needed to establish the amount of supplies required to sustain these forces. Unlike deployment, which involves only Army units, sustainment involves the Air Force, Army, Coast Guard, Marine Corps and Navy. As with the ideal mix of ship-types, this subject has been studied extensively. The primary problem is assembling the detailed tabulated data into a useful form for logistics mobility planning.

In assembling the data for planning purposes, we chose to use a method already used by some strategic planners. Rather than attempt to work with classes of supplies, we placed all supplies into three groups - resupply, ammunition and petroleum, oil and lubricants (POL).(3) Resupply includes all classes of supplies except Class V - ammunition and Class III - POL. For example, resupply includes food, medical items, etc.

To account for battle losses, we used a fourth group - unit equipment.

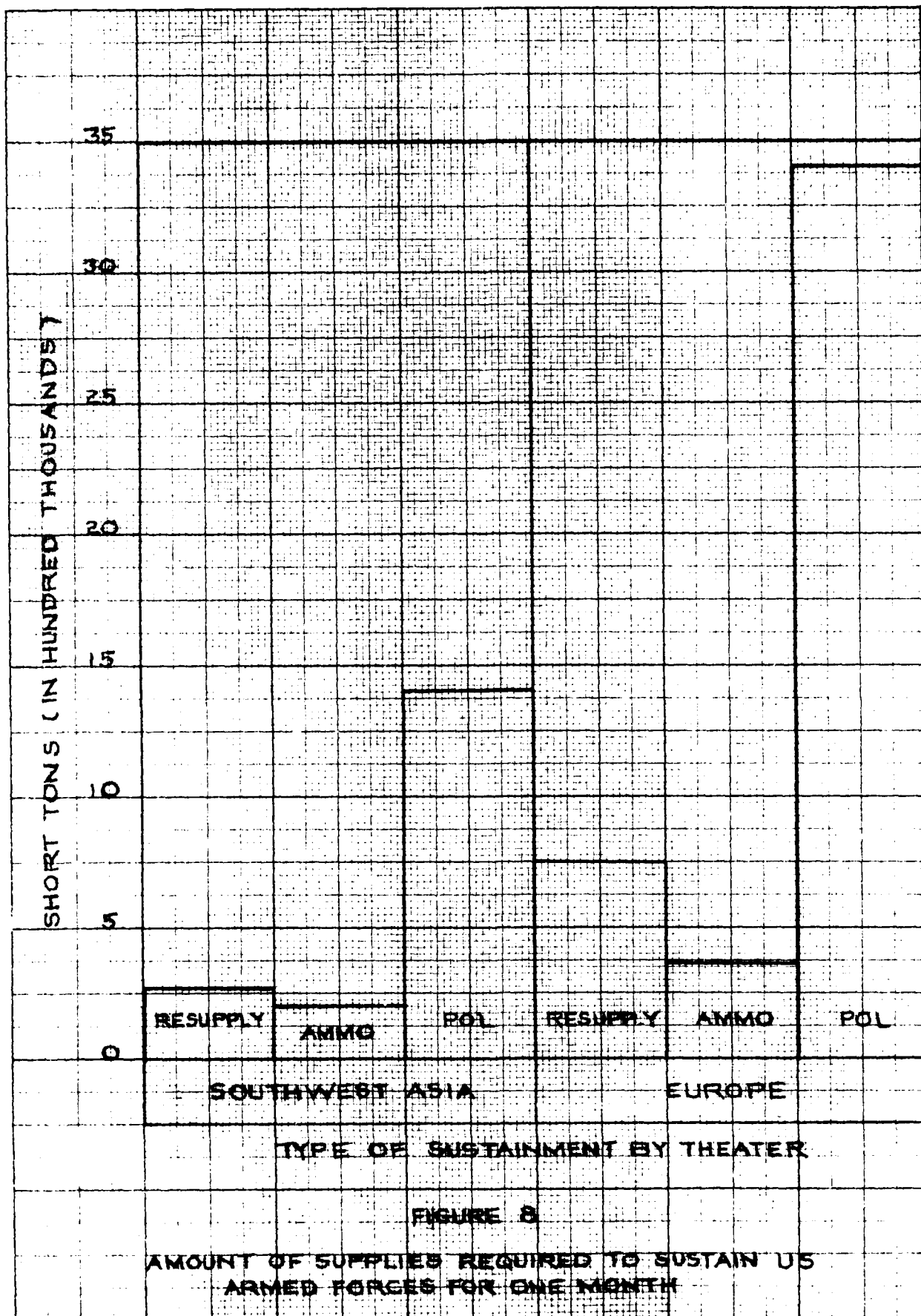


Figure 8 shows the amounts of resupply, ammunition and POL required to sustain US armed forces for one month in the Southwest Asia and European theaters. The total amount of supplies to sustain both theaters for one month is about 6.5 million short tons.(4) To put this number in perspective, we would need 650 Victory ships, just to load this amount of supplies. It is important to note that these numbers are based on requirements to sustain US armed forces. For the purposes of this study, we have not included any requirements for sustaining allied armed forces.

Fortunately, we are not constrained to transport all the resupply and ammunition by Victory ships or all the POL in World War II tankers, such as the T-2 tanker with a deadweight of about one and one half times that of a Victory ship.

In determining the numbers of ships required for sustainment, we made the following assumptions:

- o Resupply is carried in containerships.
- o Ammunition is carried in break-bulk ships.
- o POL is carried in 30,000 to 90,000 deadweight tankships.
- o Initially, only US ships are employed in the Southwest Asia theater.
- o At D plus 26, European (NATO) ships are available for both theaters.

Also, we selected an average deadweight (DWT) for each of the three types of ships that reflected whether the ship was of US or European registry. Table IV-2 shows the variation in the average deadweight of the three types of ships based on registry.(5)

TABLE IV-2

Average Deadweight Based on Ship Type and Registry

Ship- Type	Deadweight	
	US Ships	European Ships
Containership	12,000	24,000
Break-bulk	11,350	15,530
Tankship	33,000	40,000

We determined the number of ships required to sustain our forces for one month by matching the amount of sustainment in Figure 8 with the appropriate deadweight value in Table IV-2.

Keeping in mind that only US ships are going to initially supply US armed forces in the Southwest Asia theater, the number of ships required is 22 containerships for resupply, 18 break-bulk ships for ammunition and 43 tankships for POL. In a similar manner for Europe, we determined that 32 containerships, 24 break-bulk and 85 tankships are required. An interesting aside is that two short tons of resupply and eight short tons of POL are required for each short ton of ammunition shipped to sustain US armed forces.

Figure 9 shows the number of RC-RO ships required to sustain unit equipment losses. The figure was developed using the following estimates of unit equipment for the armed forces shown:

Army division	250,000	short tons
Air wing	5,000	short tons
Marine Amphibious force	50,000	short tons
Navy Battle Group	19,000	short tons

Also, 15,000 long tons were used as the average deadweight of a RC-RO

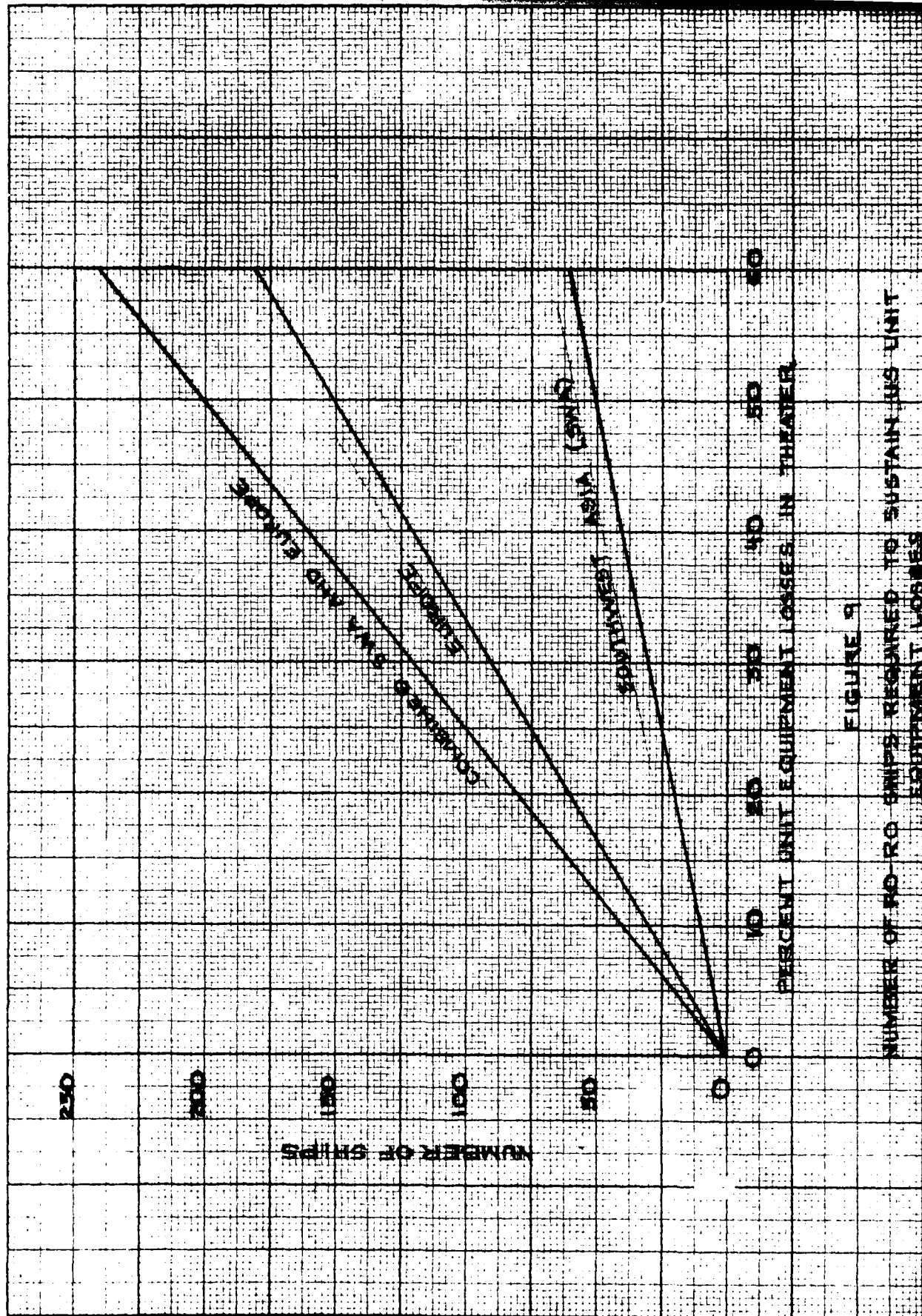


FIGURE 9

NUMBER OF RO-RO SHIPS REQUIRED TO SUSTAIN US UNIT EQUIPMENT LOSSES

ship. For the purposes of this study, we assumed an intense war with 20 percent unit equipment losses each month in both theaters. With these losses, 20 RC-RO ships would be required to sustain the US armed forces in Southwest Asia, and 60 RC-RO ships for Europe.

Combining the numbers of ships required for resupply, ammunition, POL and unit equipment, we would need 103 monthly ship arrivals for Southwest Asia and 201 for Europe. This is shown in Figure 10. Accounting for voyage time and turn around time, at least 309 ships are needed for Southwest Asia and 402 ships for Europe. These numbers do not account for any ship losses.

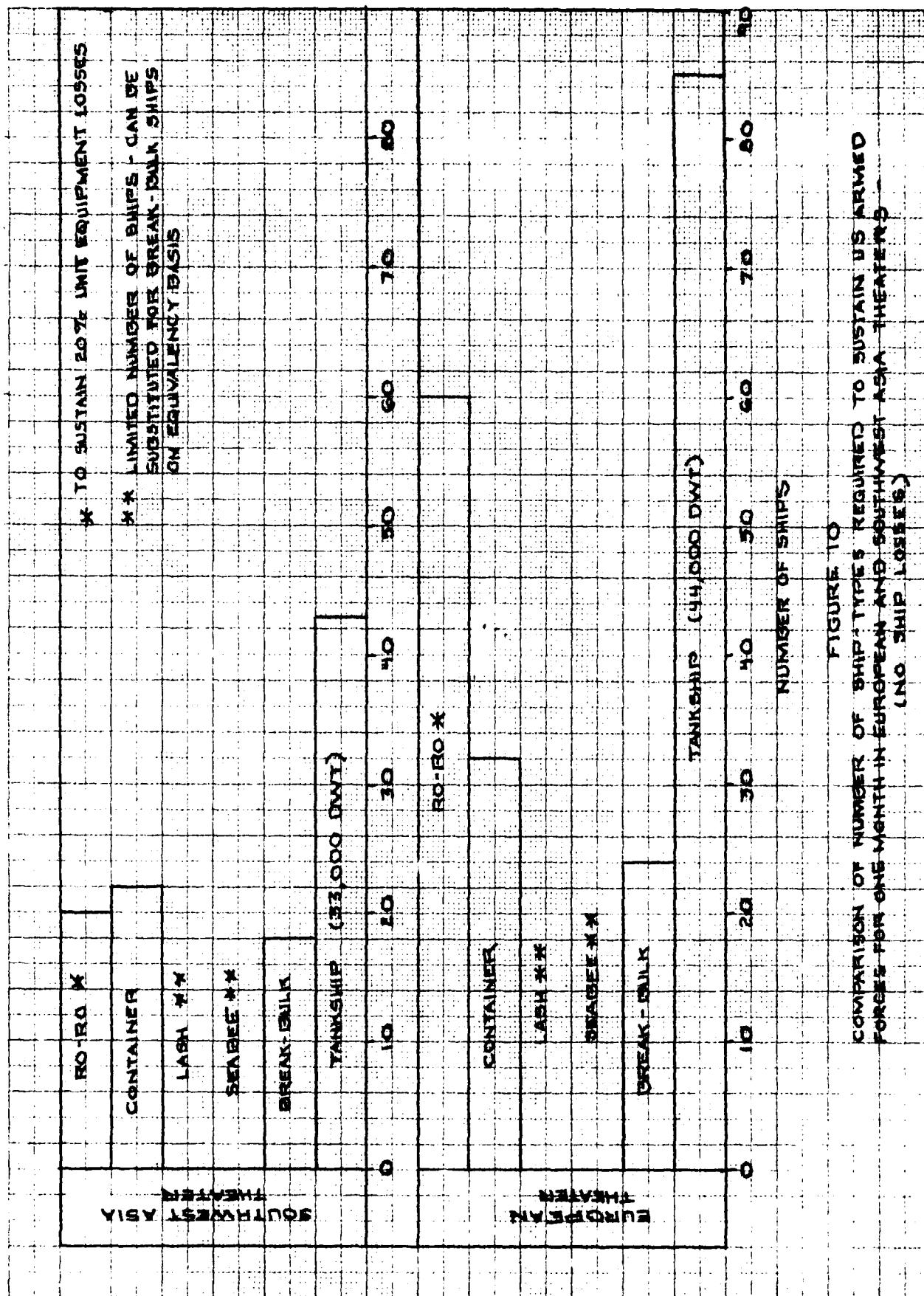


FIGURE 10

COMPARISON OF NUMBER OF SHIP TYPES REQUIRED TO SUSTAIN US ARMED FORCES FOR ONE MONTH IN EUROPEAN AND SOUTHWEST ASIA THEATERS - (NO SHIP LOSSES)

CHAPTER IV

ENDNOTES

1. Interview with G. Marsh Johnson, CAPT, Senior Service Representative, US Army War College: February 1982.
2. US Army War College, Force Planning Handbook, pp. VIII-9 to VIII-11.
3. Interview with Vincent J. Fenerty, Command and Control Technical Center, Pentagon, Washington: 18 March 1982.
4. Ibid.
5. US Department of Commerce, NATO Vessel Listing, (computer printout).

CHAPTER V

MERCHANT SHIPS AVAILABLE

Source Of Ships

Depending on the source, one can find a wide range of estimates regarding the number of merchant ships available to the United States in a wartime situation. As you might expect, the number of ships is dependent to some degree on the scenario. For example, in a limited Southwest Asia scenario, one would not consider the NATO merchant ships as a given asset.

For our scenario, we considered US registered, NATO and EUSC merchant ships to be given assets. With that as a starting point, we evaluated these assets regarding their usefulness in deploying and sustaining our armed forces. Small break-bulk ships less than 10,000 DWT and large crude oil tankships of over 90,000 DWT are of limited, if any, value in deploying and sustaining our forces. Table V-1 shows the shipping assets that were identified for use in this scenario.

TABLE V-1

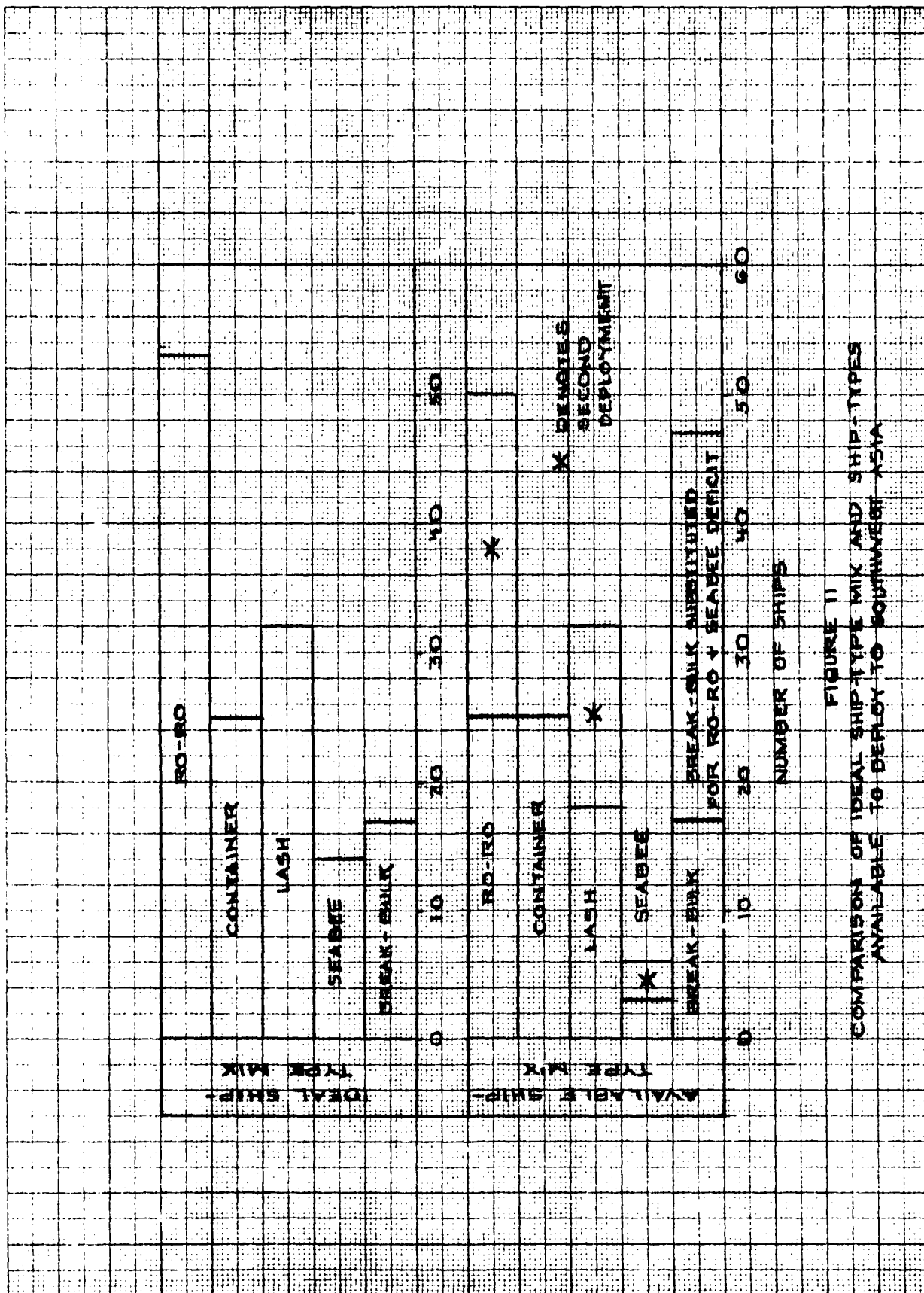
Number of Available Ships by Ship-Type and Source(1) (2) (3)

Ship-Type	Source		
	US	NATO	EUSC
RO-RO	25	76	9
Containership (self-sustaining)	77	35	6
Containership (non-self-sustaining)	101	125	-
LASH	18	3	3
SEABEE	3	-	-
Break-bulk	205	371	9
Tank ship	187	130	140
Subtotal	616	740	167
TOTAL	1523		

Comparing the various ship-types to the total number of ships available, we found that break-bulk ships account for 38 percent of the total, tankships for 30 percent, non-self-sustaining containerships for 15 percent, self-sustaining containerships for 8 percent, RO-RO ships 7 percent, LASH ships 1 1/2 percent and SEABEE ships 1/2 percent.

Southwest Asia Deployment

The significance of the above percentages can be seen in Figure 11, a comparison of the ideal ship-type mix with those available to deploy US armed forces to Southwest Asia. In our analysis, 53 RO-RO ships were required to deploy the five Army divisions, but only 25 ships were



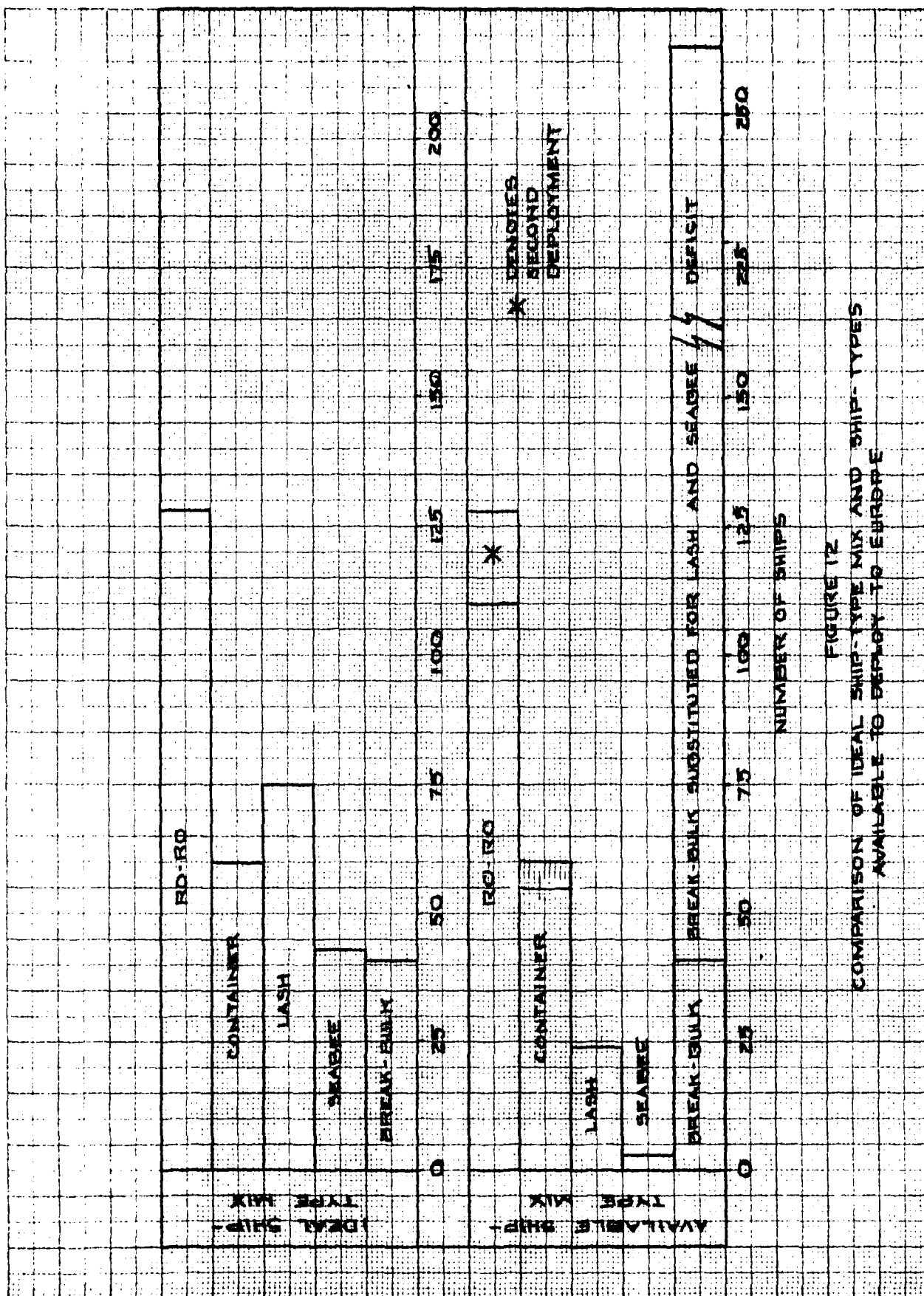
available. If 53 RO-RO ships were available, all unit equipment could be deployed by D plus 5. Using the 25 available RO-RO ships, less than one half the unit equipment was deployed by D plus 5. These ships had to make a second deployment. As a result, the remainder of the unit equipment did not arrive until D plus 15, two and one-half months later. Six break-bulk ships were needed to make up for three RO-RO ships required but not available. Sufficient self-sustaining container ships were available to deploy the containerized cargo by D plus 8.

The LASH and SEABEE ships are in short supply. Only 56 percent of the required LASH ships and 21 percent of the required SEABEE ships are available. The deficit in LASH ships can be offset by deploying these ships twice. As with the RO-RO ships, the consequence is that the equipment shipped in the second deployment does not arrive until D plus 5. The deficit in SEABEE ships can be partially offset by a second deployment. However, 24 break-bulk ships were needed to make up for a deficit of eight SEABEE ships that remained even with a second deployment.

Sufficient break-bulk ships were available to deploy the required break-bulk cargo and make up the deficits in the available RO-RO and SEABEE ships.

European Deployment

Deploying 12 Army divisions to Europe is different from the Southwest Asia deployment in that 740 NATO ships become available and the voyage time is reduced about 70 percent.(4) In Chapter I, we pointed out that NATO has pledged 400 ships from a pool of about 600. The ships pledged are the dry cargo type. The analysis shows that 740 NATO ships were needed and 130 must be tankships of an appropriate size to sustain



armed forces. As seen in Figure 12, 128 RO-RO ships are required and 110 are available. In our analysis, deployment of US armed forces started at D plus 22. By D plus 25, one week before the Soviet Union opened the second front in Europe, 34 percent of the unit equipment was deployed. By D plus 26, 86 percent was in place. The remainder arrived by D plus 29 on 18 RO-RO ships deployed for a second time. All available US registered, NATO and EUSC RO-RO ships were used to deploy the unit equipment.

Sufficient non-self-sustaining containerships were available to deploy the containerized cargo by D plus 25.

Again there is a shortage of LASH and SEABEE ships. Only 32 percent of the required LASH ships and seven percent of the SEABEE ships are available. In our analysis, we did not deploy these ships again for two reasons. First, the deficit in available ships is so large that it would take months to deploy the cargo ideally suited for barge-ship systems. Secondly, a substantial excess break-bulk capacity existed. This allowed us to substitute 222 break-bulk ships for the unavailable LASH and SEABEE ships. Available break-bulk ships exceeded the required number by 900 percent.

Sustaining in Southwest Asia

In our scenario, special forces are airlifted to the threatened nation and arrive on D day. These special forces are the equivalent of three separate brigades. They enter the threatened nation with two weeks of food and ammunition. To sustain them with resupply and ammunition, three fast, self-sustaining containerships, three break-bulk ships and eight tankships proceed to a US port by D minus 5, load and depart for Southwest Asia by D minus 3, proceed via the Suez Canal to arrive at

D day and complete offloading by D plus 2.

RO-RO ships are not available for sustaining in Southwest Asia. Shortly after completing the deployment of US armed forces to Southwest Asia, these ships are needed to deploy our forces to Europe. Afterwards, the RO-RO ships are used to sustain the US armed forces in Europe with unit equipment. To sustain our forces in Southwest Asia with unit equipment, 40 break-bulk ships are substituted for the required 20 RO-RO ships. Alternatives include the use of barge-ship systems, or the acquisition of 20 additional RO-RO ships.

A shortage of fast, self-sustaining containerships exists for sustaining US armed forces in Southwest Asia. Our analysis shows that all 37 fast, self-sustaining containerships are in use by D plus 12. Only slow ships are available. As a result, for the six week period between D plus 15 and D plus 21, only four weeks of resupply are provided. At D plus 23, 50 percent of resupply arrives on fast ships. The remaining 50 percent does not arrive until D plus 28 aboard slow ships. These shortfalls continue through the scenario. One alternative is the substitution of break-bulk ships for the unavailable self-sustaining containerships. This can be done, recognizing that cargo handling times would increase by a factor of 3 to 4. A second alternative is to acquire 22 additional fast, self-sustaining containerships.

With 43 fast and 29 slow break-bulk ships, we cannot deploy US armed forces to Southwest Asia and sustain them with ammunition simultaneously. Except for the sustainment of US special forces, the required amount of ammunition would not arrive until D plus 13. This is unacceptable since our forces are arriving between D plus 5 to 7. At least 18 fast break-bulk ships loaded with ammunition are required each month. In the analysis, the RRF was used as if they were active ships.

This is consistent with the intent to have these ships on berth in five to ten days. Therefore the NDRF is our only reserve for break-bulk ships.

Figure 13 shows the NDRF activation schedule.(5) The schedule calls for the RRF ships to be activated during the first two weeks, with the remainder of the NDRF being activated over the following seven weeks. The ships, breakout times, shipyards, and completion times have already been identified. Given a few weeks slippage in the schedule, the NDRF could be activated within three months. We found it is necessary to activate the NDRF at D minus 3 to provide 18 additional break-bulk ships to sustain our forces with ammunition.

The barge-ship systems were not available for sustainment in Southwest Asia. As with the RO-RO ships, they were used to deploy US armed forces to Europe. We chose not to use them in analysis any further because of their limited number. However, recognizing that they could be used as substitutes for break-bulk ships we determined the following ship-type equivalents:

- 1 LASH ship equivalent to 2 US registered break-bulk ships.

- 1 SEABEE ship equivalent to 3 US registered break-bulk ships.

Almost the entire US fleet of tankships is required to sustain US armed forces in Southwest Asia. The first group of 43 tankships must be in route by D minus 2. Thereafter 43 tankships must arrive each month. Although there are sufficient tankships for this phase of the scenario, the abundance of tankships that we take for granted in peacetime is used up quickly in wartime.

Sustaining In Europe

As pointed out earlier, all of the 25 US registered RO-RO ships are

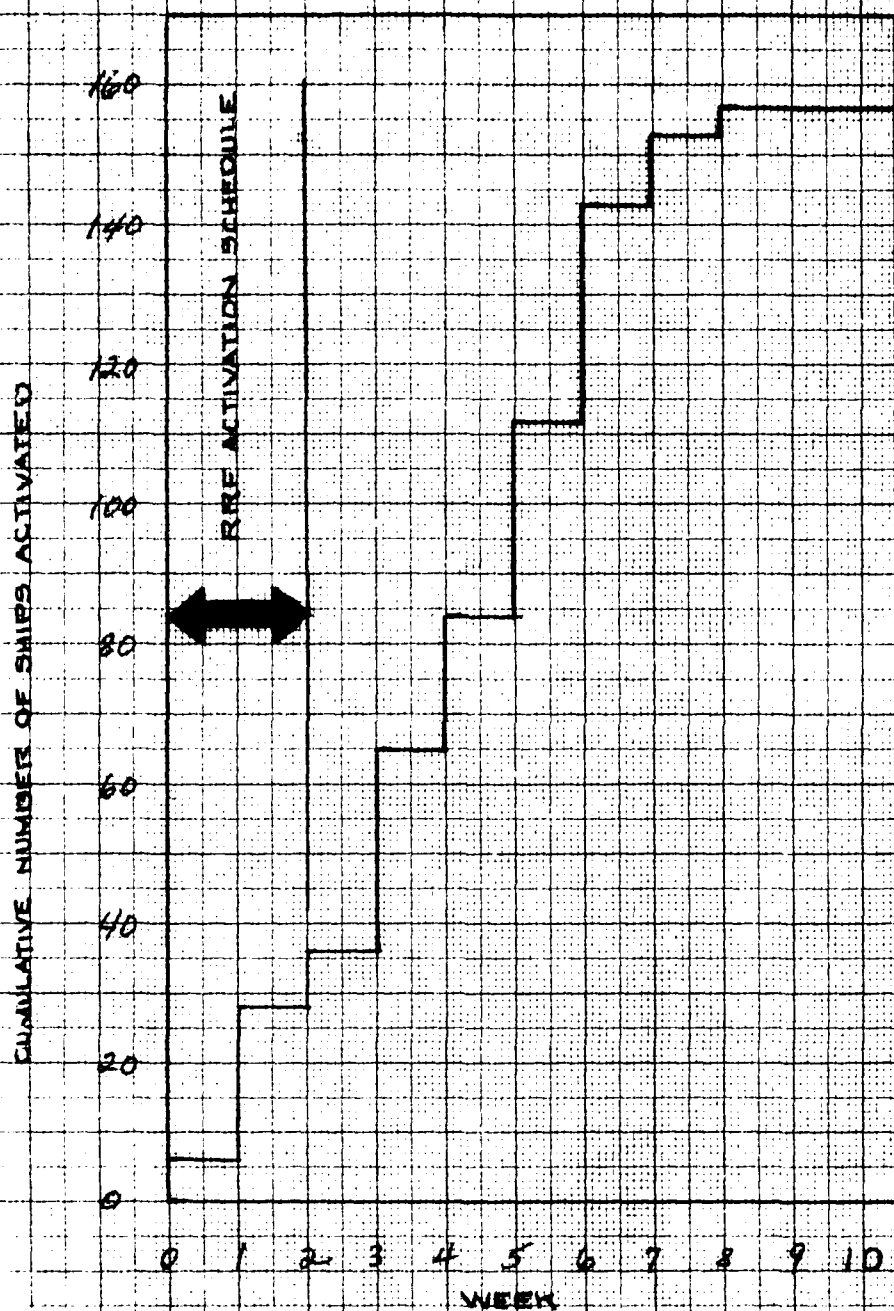


FIGURE 13
 NDRF ACTIVATION SCHEDULE
 FROM DATE OF ACTIVATION ORDER

required to sustain our forces in Europe, along with 76 NATO and nine EUSC RO-RO ships. Until D plus 36, only 70 percent of the required RO-RO ships are available to sustain US armed forces in Europe. The deployment to Europe conflicts with the sustainment for two and one-half months after the second front is opened.

The 101 US and 125 NATO nonself-sustaining containerships provide two and one-half times the required number of ships to sustain US armed forces with resupply.

The 371 NATO break-bulk ships are used for both deployment and sustainment. Of this number, 57 are fast ships and 314 are slow ships. Initially, the NATO ships provide almost eight times the required number of break-bulk ships to sustain US forces with ammunition.

To sustain US armed forces in Europe with POL, 121 NATO and 140 EUSC tankships are used. These ships range in size from about 30,000 to 90,000 DWT. Sufficient smaller NATO tankships are available to support coastal transportation around Western Europe. Likewise, sufficient larger EUSC tankships, such as very large crude carriers, are available to support the importing of bulk crude oil into the United States.

CHAPTER V

ENDNOTES

1. Congress, Defense Sealift Capability, pp. 51-52.
2. US Department of Commerce, NATO Vessel Listing, (computer printout).
3. US Department of Commerce, A Statistical Analysis of the World's Merchant Fleets, pp. 252-288.
4. Ibid.
5. US Department of Commerce, MARAD Operations Plan 001 - Basic War Plan, pp. E4C1-C10.

CHAPTER VI

MERCHANT SEAMEN

Sealift readiness depends just as heavily on adequate maritime manpower as it does on adequate vessels. The commercial oceangoing maritime work force is composed of both licensed and unlicensed personnel. Those personnel licensed by the US Coast Guard include deck officers (Master, Chief Mate, 2nd and 3rd mates), engineering officers (Chief Engineer, 1st, 2nd, and 3rd assistant engineers), and radio officers. An additional group (not licensed by the USCG) can be identified as staff officers. Unlicensed personnel include seamen assigned to the deck, engineering and stewards departments aboard ship. Unlicensed personnel can be further identified as either skilled or unskilled. Table VI-1 illustrates typical licensed and unlicensed manning requirements for typical World War II type ships and for modern post-WW II ships. In this study it is assumed that an average manning requirement of 40 personnel per ship exists.

Data available from the Seaman's Employment Analysis System (SEAS), which records all discharge certificates of mariners who sailed under Articles within specific annual periods, presents a fairly accurate picture of the size and age of the seagoing workforce as well as the attrition rates of its members.

At the present time MSC provides about one of every four oceangoing

TABLE VI-1

Manning Requirements for Typical US Flag
Commercial Deep-Sea Ships of 1,000 GRT and Over

Ship Type	D.O.	E.O.	R.O.	S.O.	U. D. \ U. E.				Stewards Dept.	Total Crew
					S.	US.	S.	US.		
WWII Victory	5	6	1	-	7	3	8	3	10	43
WWII T-2 Tank- ship	5	6	1	-	6	3	8	3	9	41
Post-WWII Break-bulk	4	4	1	-	7	1	3	1	4	25
Post-WWII Tankship	5	5	1	-	7	3	5	2	6	34

Notes: D.O. - licensed Deck Officers
 E.O. - licensed Engineering Officers
 R.O. - licensed Radio Officers
 S.O. - Staff Officers - Peacetime billets vary according to
 whether or not passengers are carried
 U.D. - unlicensed deck personnel; S - skilled, US - unskilled
 U.E. - unlicensed engineering personnel; S-skilled, US -
 unskilled

billets for US merchantmen. This figure of about 6000 billets is composed of about 4000 Civil Service employees of the US Navy and about 2000 union crewmen manning chartered and/or contractor - operated ships. In the entire US maritime picture about 47,000 mariners compete for less than 20,000 billets.(1)

The number of mariners has steadily decreased from a high of 55,995 in 1967 to 19,216 in 1981.(2) This decrease of 36,777 seafarers represents the decline in the number of vessels in the US Merchant Marine as aggravated by newer and more efficient ship types which sail with smaller crews. As indicated in Table VI-1, the primary decrease in the

number of seafarers required to man a modern ship has occurred in unlicensed engineering personnel and in the stewards department.(3) The overall decline of the US Merchant Marine has been occurring since the 1920's with temporary buildups occurring during times of crisis - World War II, Korea, and Vietnam, as shown in Figure 14.

In June 1981, MARAD estimated that there were about 2.4 merchant seamen available to fill every available billet.(4) This excess of men over billets represents the available reserve that we now depend upon to support the US sealift requirement in the event of a national emergency. It is from this manpower pool that ships now sitting inactive in the NDRF (and RRF) would be crewed.

At first glance this margin of 2-plus men for every active seagoing billet would appear to be a reasonable and sufficient pool from which to man the existing reserve fleets. However, based upon 1976 SEAS data, it has been determined that the median age of the overall workforce is about 50 years.(5) In addition, the average age has remained at about the same level for many years now and this infers that "bloc obsolescence" of the workforce would occur within the coming decade.(6) As shown in Figure 15, groups 1 and 2, representing ages under 45, are rapidly decreasing as a major percentage of the total workforce while groups 3 and 4, representing ages 45 and older, are rapidly increasing. By 1985 it is projected that groups 1 and 2 collectively will represent about 10 percent of the total number of merchant seamen while groups 3 and 4 will represent about 90 percent of this workforce. Further, group 4, being those seamen over 55 years of age, represents the larger segment of this 90 percent.

Rear Admiral Bruce Keener, commander of the MSC in June of 1981,

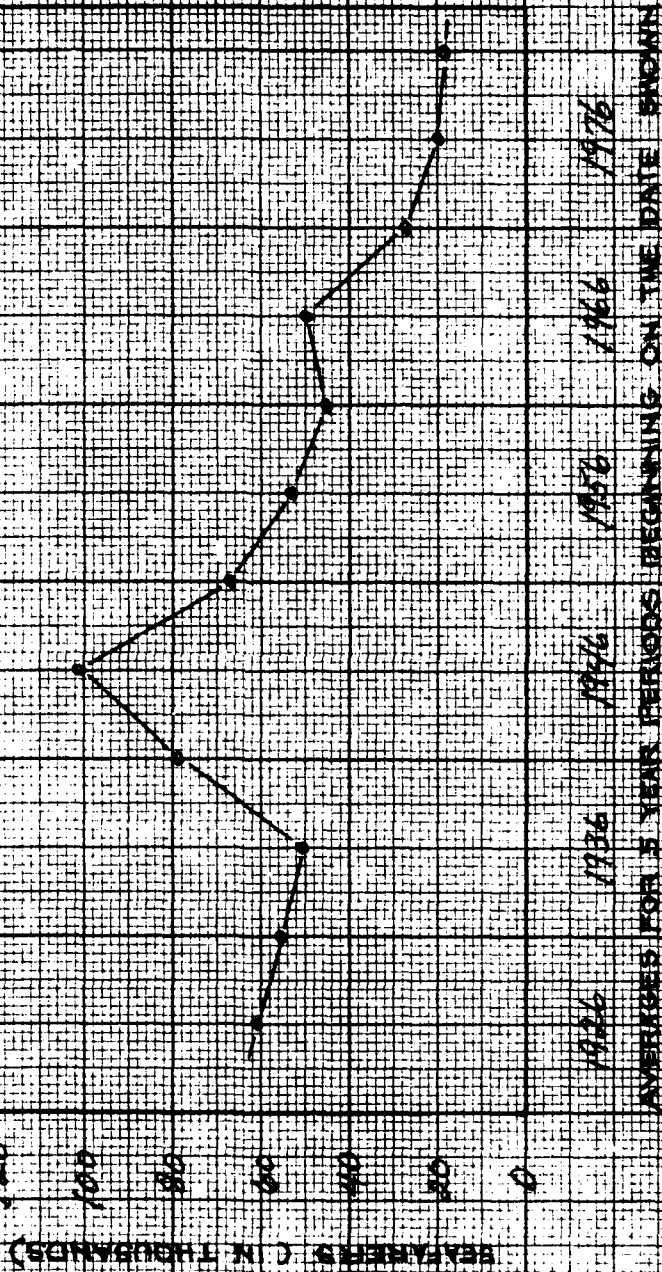


FIGURE 14
 SEAFARING EMPLOYMENT ON SEAGOING MERCHANT SHIPS OF
 1800 GROSS TONS AND OVER

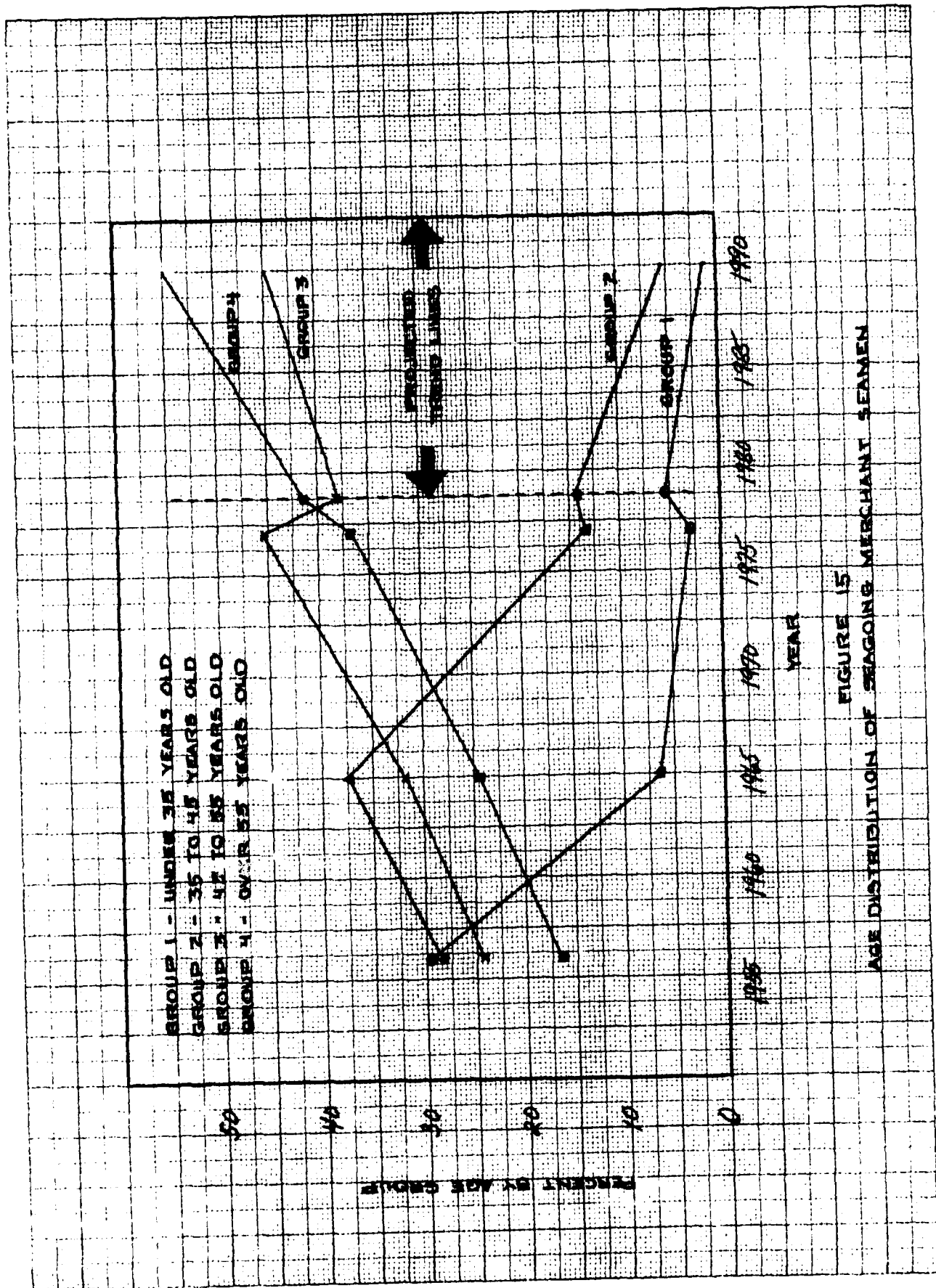


FIGURE 15
AGE DISTRIBUTION OF SEAGOING MERCHANT SEAMEN

made the following statement as his summary of the manpower problem -
"there will be a dramatic turnover in the Marine workforce in the 1990s as present employees retire."(7) He indicated that "We no doubt will have difficulty in meeting ship activation schedules. We no doubt will have delays in sailing. The greater the scale of the emergency, the greater the manpower problem will be."(8)

Our concern here is whether or not a sufficient number of able-bodied merchant seamen will be available from the peacetime mariner force to man the ships activated from the RRF and the NDRF in response to a contingency situation; if they will be properly trained, ready, and able to respond in time to meet the ship activation schedules.

If the NDRF, including the RRF component, were fully ordered into a phased activation schedule today, the requirement would be to man 216 vessels within a 60 - day period. Over half of these ships are the World War II vintage Victory class ships.

Tomas Martinez, Secretary - Treasurer of the National Maritime Union of America, AFL-CIO has recently commented before the House Committee on Merchant Marine and Fisheries that manning the NDRF will not occur without problems in today's maritime labor market. He stated: "We estimate that 30 percent of the unlicensed crew necessary to man the NDRF would be entry or unskilled ratings. The remaining 70 percent calls for special certification and experience."

"Since the majority of ships in the NDRF are World War II Victorys, there could be a need for three firemen/watertenders and three oilers on each ship. These occupational skills have been made obsolete through new construction and engine room design so that they could also present serious manpower problems in time of emergency expansion."(9)

It also must be kept in mind that the Victorys, by today's modern ship standards, offer to the mariner extremely poor working and living condi-

tions and the prospect of a higher level of required maintenance to keep the vessels operational.

Much of the equipment that is aboard some of the older ships has been modified by technological changes on newer ships. Younger mariners will likely require refresher courses to enable them to deal with the older equipment found on the Victory - class of ship. Such courses would include electrical system courses (the older ships have DC electrical systems vs. the AC systems found on more modern vessels) and courses on the pumping systems found on the older T-2 type of tank-ship.(10)

Attrition and age of unlicensed personnel is one of the major problems to be faced when the reserve fleets are activated. Referring to Figures 16 and 17, it can be seen that the excess of men over billets reserve supply of unlicensed personnel is not projected to be maintained into the future. By 1985 the number of seagoing unlicensed personnel in all categories (deck, engineering and stewards department) is projected to fall below the number of billets required to be filled. The reason for this anticipated deficit of seafarers is that while the number of billets remains basically constant in the years after 1980 as shown in Figure 16, the attrition of personnel to fill these billets is projected to continue to drop during these same years as indicated in Figure 17. Labor market factors will probably act to moderate this shortage in the coming years.

Based upon 1976 SEAS data it is anticipated that attrition rates of licensed officers is expected to be in the range of 40 to 45 percent (depending upon speciality) over the period between 1977 and 1985.(11) Shortages are likely to be especially high for deck and engineering officers. As shown in Figure 18 the number of billets for licensed

seagoing officers in all categories (deck, engineering, radio, and also for unlicensed staff officers) during the period from 1980 through 1985 is projected to remain basically constant. Figure 19 indicates that the number of officers to fill these billets is expected to decline throughout the period. For the same reasons as discussed above for unlicensed personnel, the result will be a reduced level of reserve to man ships in response to a contingency situation. As can be seen from Figure 19, the decline in available Radio Officers and unlicensed staff officers is not as severe.

At the same time men are required to crew the reserve fleet vessels, other sectors of the maritime industry will be needing additional personnel to meet their increasing emergency commitments. Any manpower required to replace foreign crewman on EUSC vessels would also have to be added to the crew requirements discussed above.

Depending upon the level of activation of the reserve fleets, it may not be possible to fully crew the vessels under peacetime man-per-billet ratios. In our society we cannot just allocate people to jobs in peacetime, no matter how critically their services are required. To obtain crews, mobilization may be necessary. MARAD has authority to obtain ships for emergency situations but there is no effective emergency authority which can force seafarers to man priority ships.(12)

Under mobilization conditions, emergency manpower sources can be used. These sources of mariners to supplement the workforce include: recalling recent retirees, postponing retirements, inducing personnel now working in other occupational areas who possess deep-sea licenses and skills to return to sea, increasing current levels of recruitment and training and lowering, on a temporary basis, the requirements for obtaining or upgrading a license to become a US Merchant Mariner.(13)

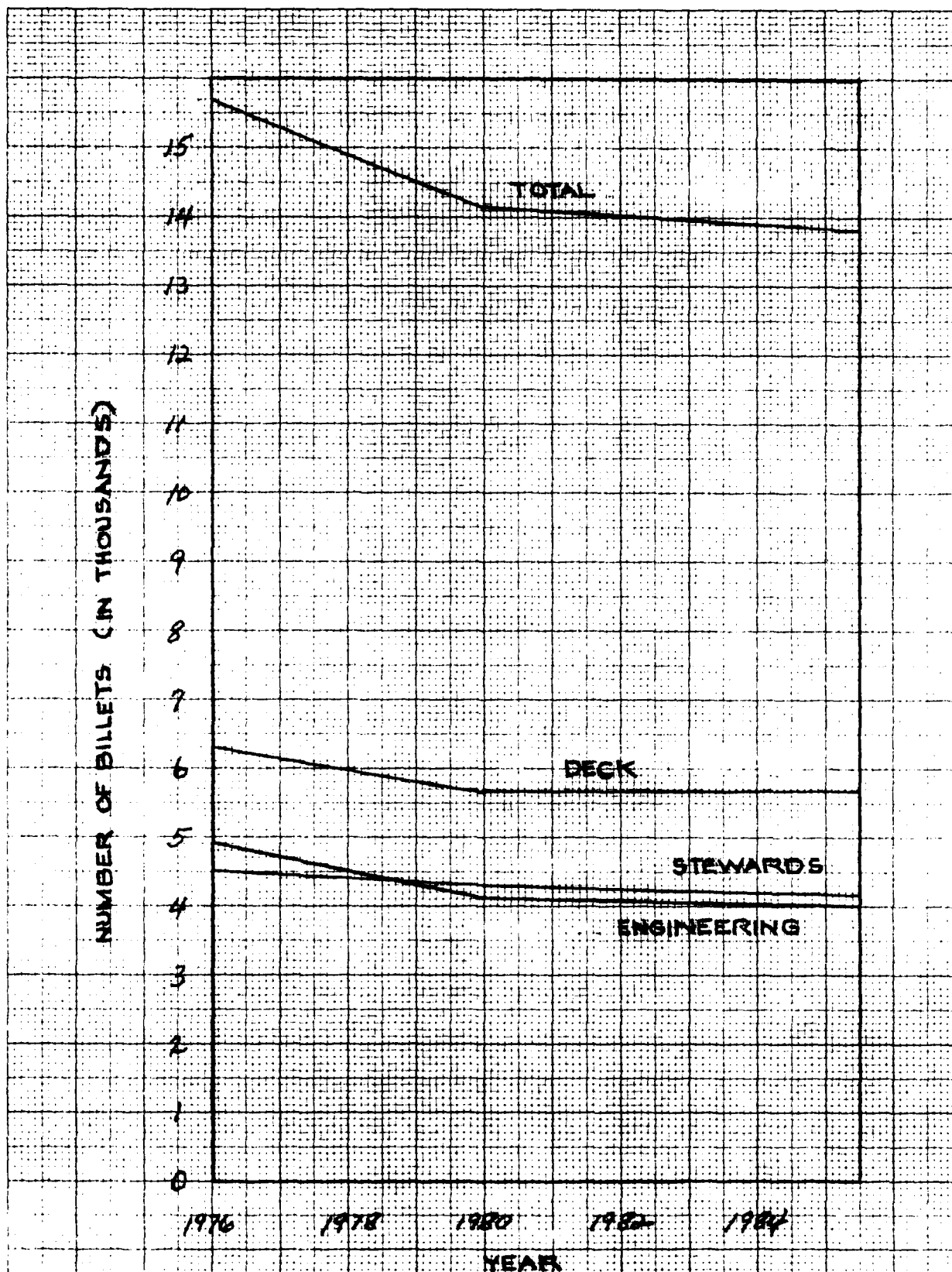
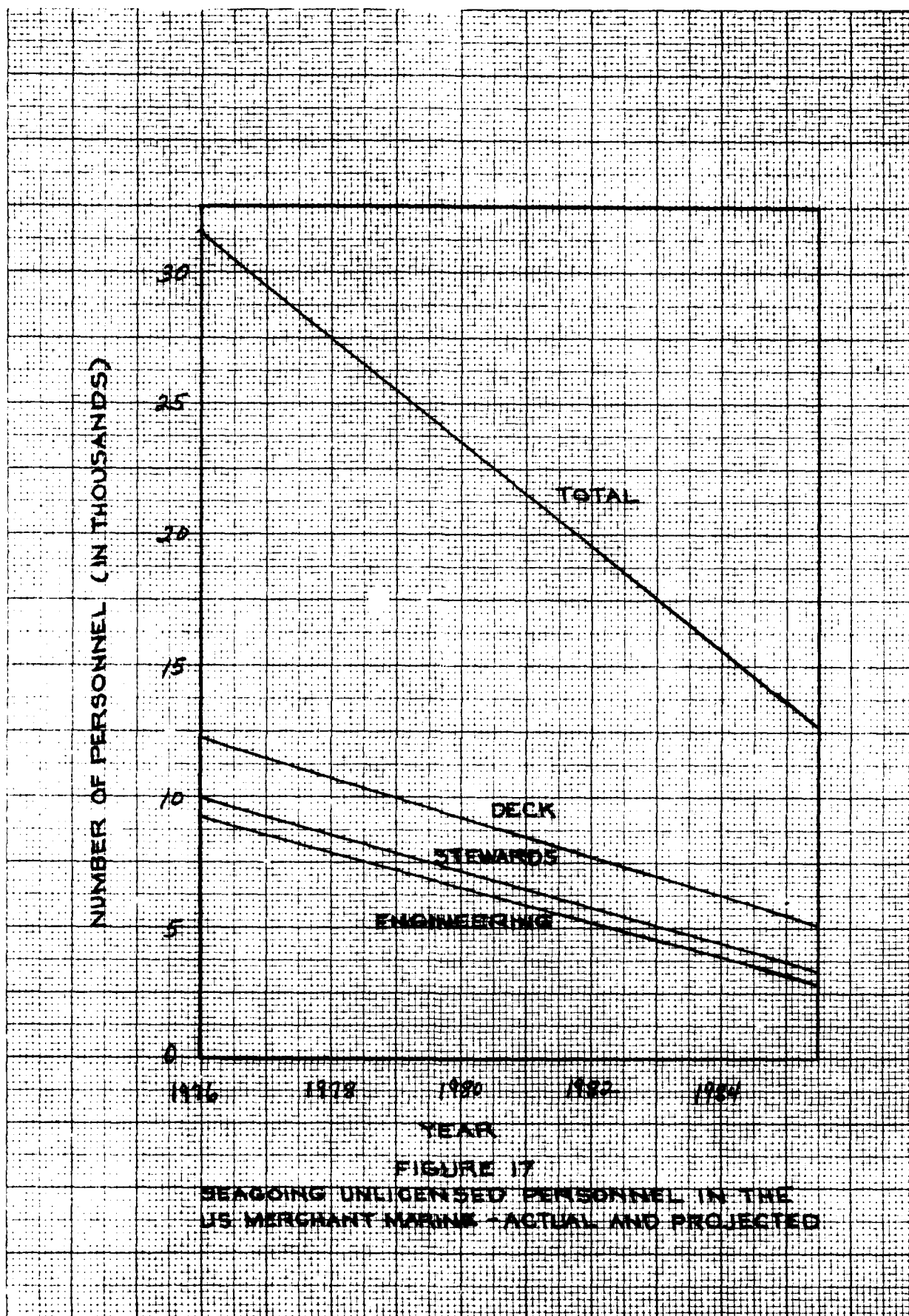


FIGURE 16
SEABOARD UNLICENSED PERSONNEL BILLETS
IN THE DE MERCHANT MARINE - ACTUAL AND PROJECTED



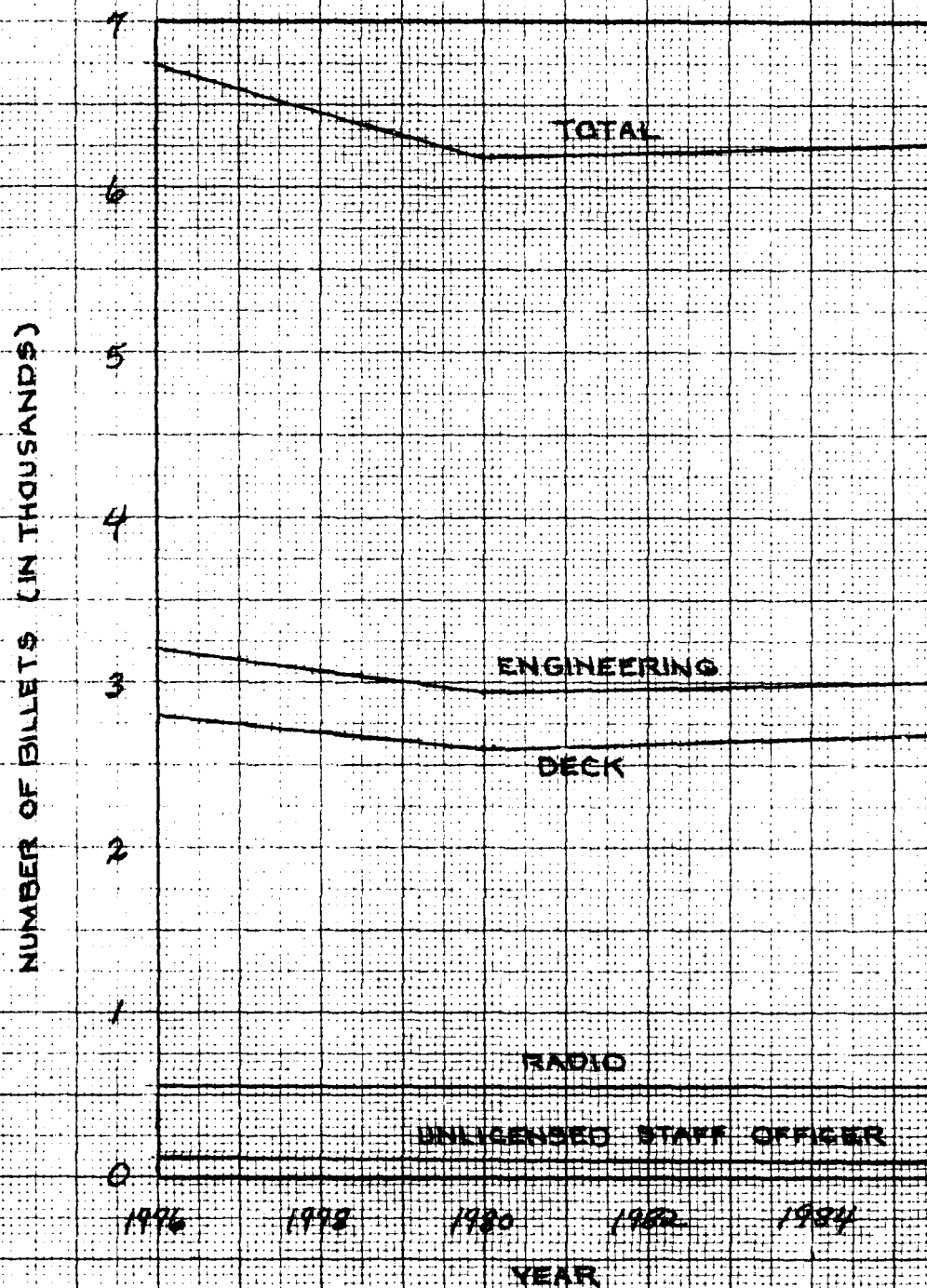


FIGURE 10
SEAGOING LICENSED OFFICER BILLETS IN THE
US MERCHANT MARINE - ACTUAL AND PROJECTED

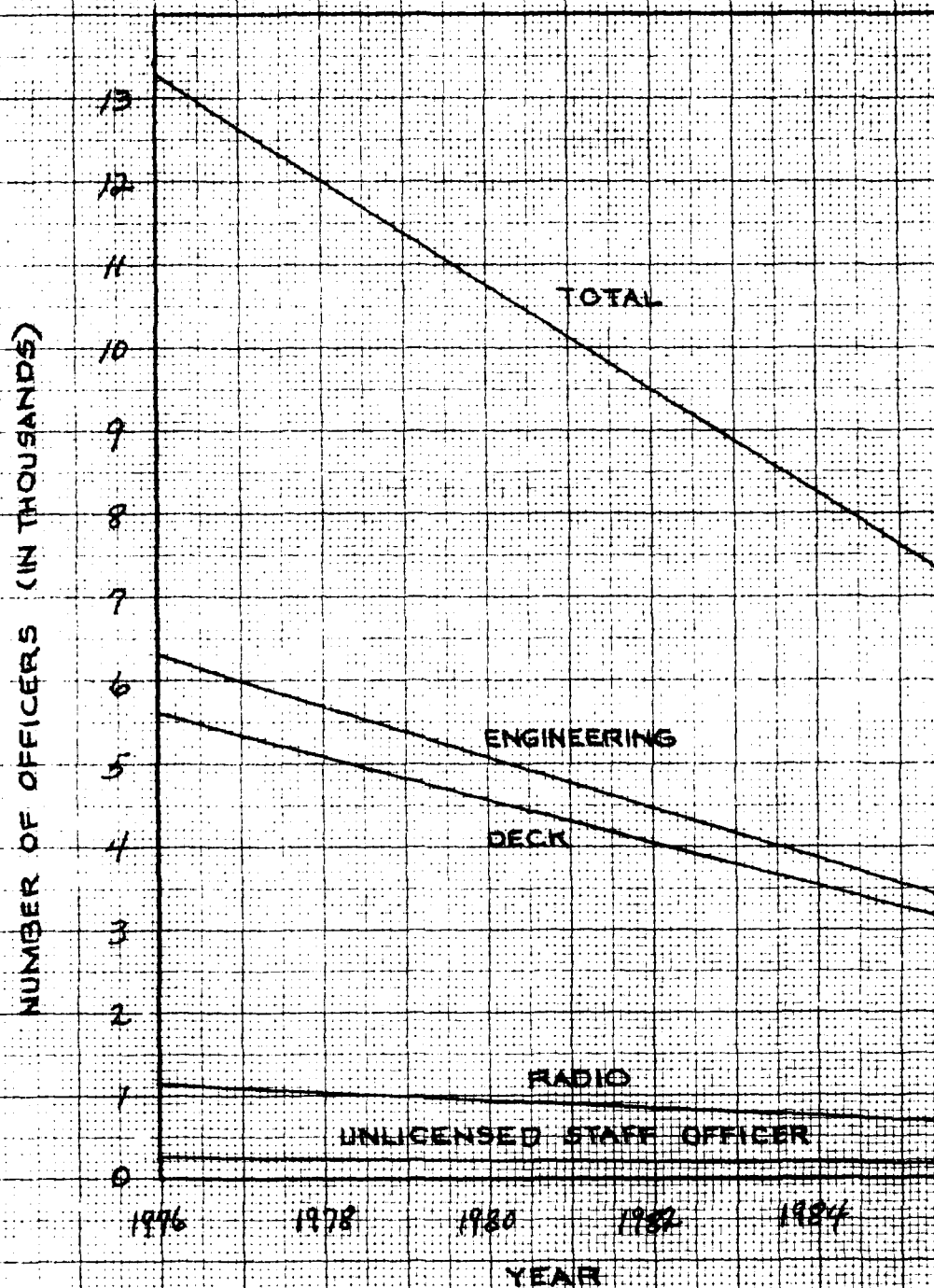


FIGURE 19
SEAGOING LICENSED OFFICERS IN THE
U.S. MERCHANT MARINE - ACTUAL AND PROJECTED

CHAPTER VI

ENDNOTES

1. Larry C. Manning, "You Don't Get What You Don't Pay For," US Naval Institute Proceedings, October 1981, p. 42.
2. Congress, Defense Sealift Capability, pp. 120-121.
3. US Department of Commerce and Department of the Navy, Civilian Seafaring Manpower Requirements in Peace and War: 1978-1984, November 1978, p. 88. (hereafter referred to as "Manpower Requirements")
4. Manning, p. 42.
5. Manpower Requirements, p. 11.
6. Manning, p. 42.
7. Ibid.
8. Ibid.
9. Congress, Defense Sealift Capability, p. 118.
10. Ibid., p. 99.
11. Manpower Requirements, p. 11.
12. Ibid., p. 17.
13. Ibid.

CHAPTER VII

ATTRITION

We found a general reluctance on the part of logistical planners to consider shipping losses or attrition in their planning. Although it is not difficult to account for attrition it is extremely difficult to get agreement on expected attrition rates or time periods over which these rates might occur.

Background

We avoided getting caught up in any one of the polarized schools of thought on this subject. Instead, we chose to analyze World War II statistics on Allied merchant shipping losses to German submarines and the forecasts of knowledgeable naval sources. Figure 20 is a graphical comparison of the Allied merchant ships sunk in World War II with the size of the German submarine fleet on a yearly basis.(1)(2)(3) The graph clearly shows that the number of merchant ships sunk was not proportional to the size of the German submarine fleet. For example, in 1940, the size of the German submarine fleet was 58 U-boats. That same year 435 Allied merchant ships were sunk by German U-boats. In 1943, a fleet of 419 German U-boats accounted for 435 Allied merchant ship sinkings. As we can see, a 700 percent increase in the size of the German submarine fleet resulted in a zero increase in the number of merchant ship sinkings. In 1944, we see that the same size German

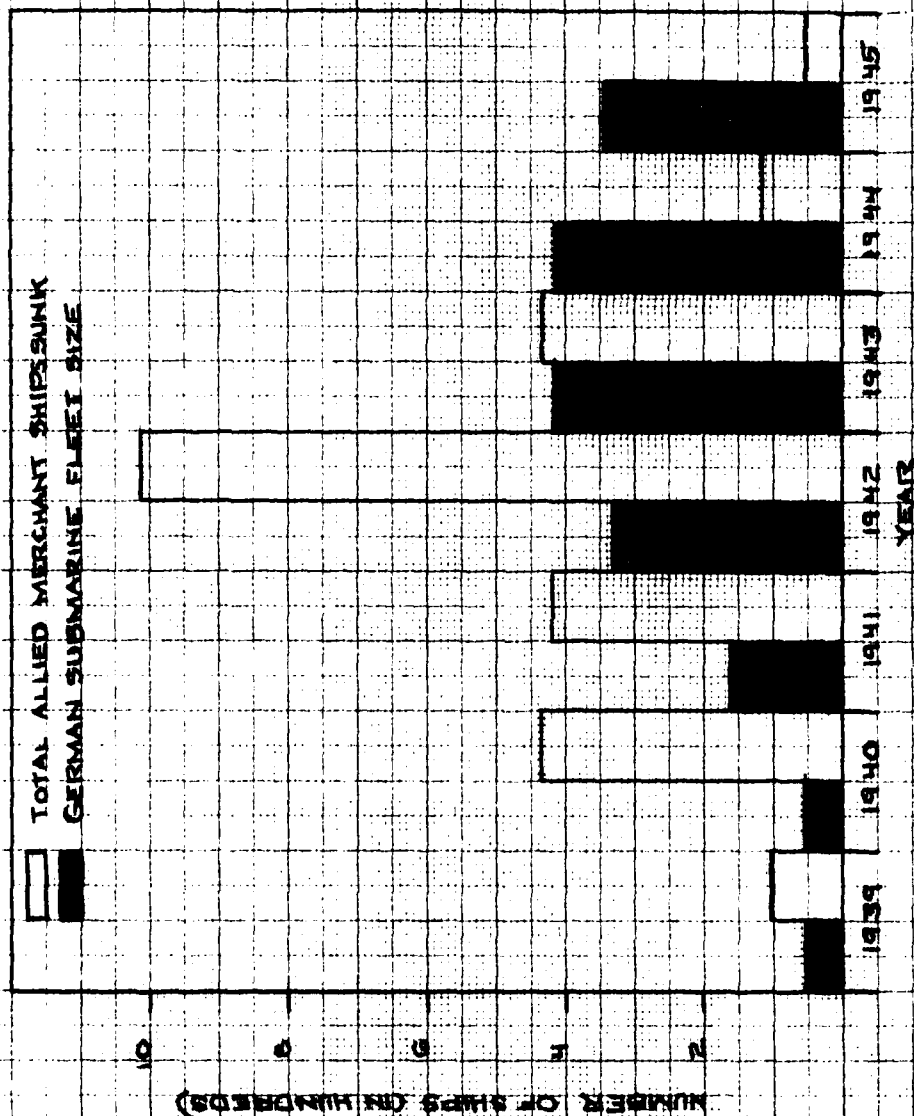


FIGURE 20
 COMPARISON OF ALLIED MERCHANT SHIPS SUNK IN WWII IN
 THE BATTLE OF THE ATLANTIC WITH THE SIZE OF THE
 GERMAN SUBMARINE FLEET

submarine fleet, 419 U-boats, sank 117 merchant ships or 27 percent of the merchant ships sunk the previous year. The lack of proportionality in the numbers of submarines to sinkings is the result of the development and refinement of anti-submarine warfare during the war. Equally important, if not moreso, was the contribution that Ultra, the intelligence the British derived from reading German naval cypers, made to winning the Battle of the Atlantic by mid-1943. Ultra enabled the Allies to read the German mind - allowing them to intercept U-boats, supply boats, and to reroute convoys out of harm's way.(4)

During the latter stages of World War II the effectiveness of the German U-boat was reduced severely by allied aircraft. From this we can infer the need to maintain control of our sea lines of communications. Furthermore, we can see that it will require some time to establish control of the sea lines of communication. In World War II attrition rates reached as high as 60 percent and it took the Allies four years to significantly reduce the attrition.(5) Today, some knowledgeable sources forecast that attrition rates will reach 30 to 50 percent levels. These forecasts appear to be best estimates based upon experience and intuition.(6)(7) However, the period of time over which these attrition rates might occur is not well established.

Assumptions

Based on the above, we made the following assumptions concerning the attrition of merchant shipping:

- a. Attrition starts at D plus 26, coinciding with the start of the naval war.
- b. The United States will emphasize control of the sea lines of communications, particularly to Europe, and establish control at D

plus 34.(8)

c. The merchant ships deploying US armed forces to Southwest Asia and Europe do not suffer any ship losses.

d. At D plus 26, the attrition for merchant ships sustaining US armed forces in Europe is 30 percent en route and 10 percent returning.

e. At D plus 26, the attrition for merchant ships sustaining US armed forces in Southwest Asia is 10 percent en route and 3 percent returning.

f. At D plus 34, the attrition rate for merchant ships sustaining US armed forces in Europe falls to 15 percent en route and 5 percent returning, for the duration of the war.

g. At D plus 34, the attrition rate for merchant ships sustaining US armed forces in Southwest Asia does not drop and remains at 10 percent en route and 3 percent returning for the duration of the war.

Although the attrition rates for Europe and Southwest Asia are estimates, we feel they are reasonable. Certainly to ignore attrition is to ignore reality. The attrition rates for merchant ships en route to Europe and Southwest Asia are at least three times as great as for those returning. The reasoning is that ships loaded with high value resupply, ammunition, POL and unit equipment are higher priority targets than empty ships returning to the United States. As such, a Soviet submarine skipper is much more likely to attack a ship laden with war supplies, even though the attack will also help to locate his submarine for Allied forces. The attrition rate is greater for Europe than Southwest Asia. This reflects the anticipated greater concentration of Soviet attack submarines in the North Atlantic Ocean as compared with the South Atlantic Ocean. Eight weeks after the naval war starts,

attrition decreases for merchant ships en route to and returning from Europe, but does not decrease for ships en route to and returning from Southwest Asia. The reasoning for this is the United States will be able to control the shorter sea lines of communication to Europe more effectively than the longer sea lines of communication to Southwest Asia. Attrition is continued for the duration of the war. This reflects the fact that limited US Navy and Coast Guard ships are available for convoy escorts.

Analysis

Using the above attrition rates, Figure 21 shows the cumulative numbers of merchant ships lost sustaining the US armed forces. The three curves reflect our forecasted losses for the Southwest Asia and European Theaters as well as the total losses. As seen in the figure, the attrition during the first month of the naval war is high with 205 merchant ships sunk by Soviet submarines. Of this number, 194 ships are lost while attempting to sustain US armed forces in Europe and 11 are lost in the Southwest Asia theater.

A total of 823 US, NATO, and EUSC merchant ships are sunk by Soviet submarines by the end of the war. Table VII-1 shows the losses by ship-type and theater:

Table VII-1
Number of Merchant Ships Lost to Submarine
Attacks by Ship-Type and Theater

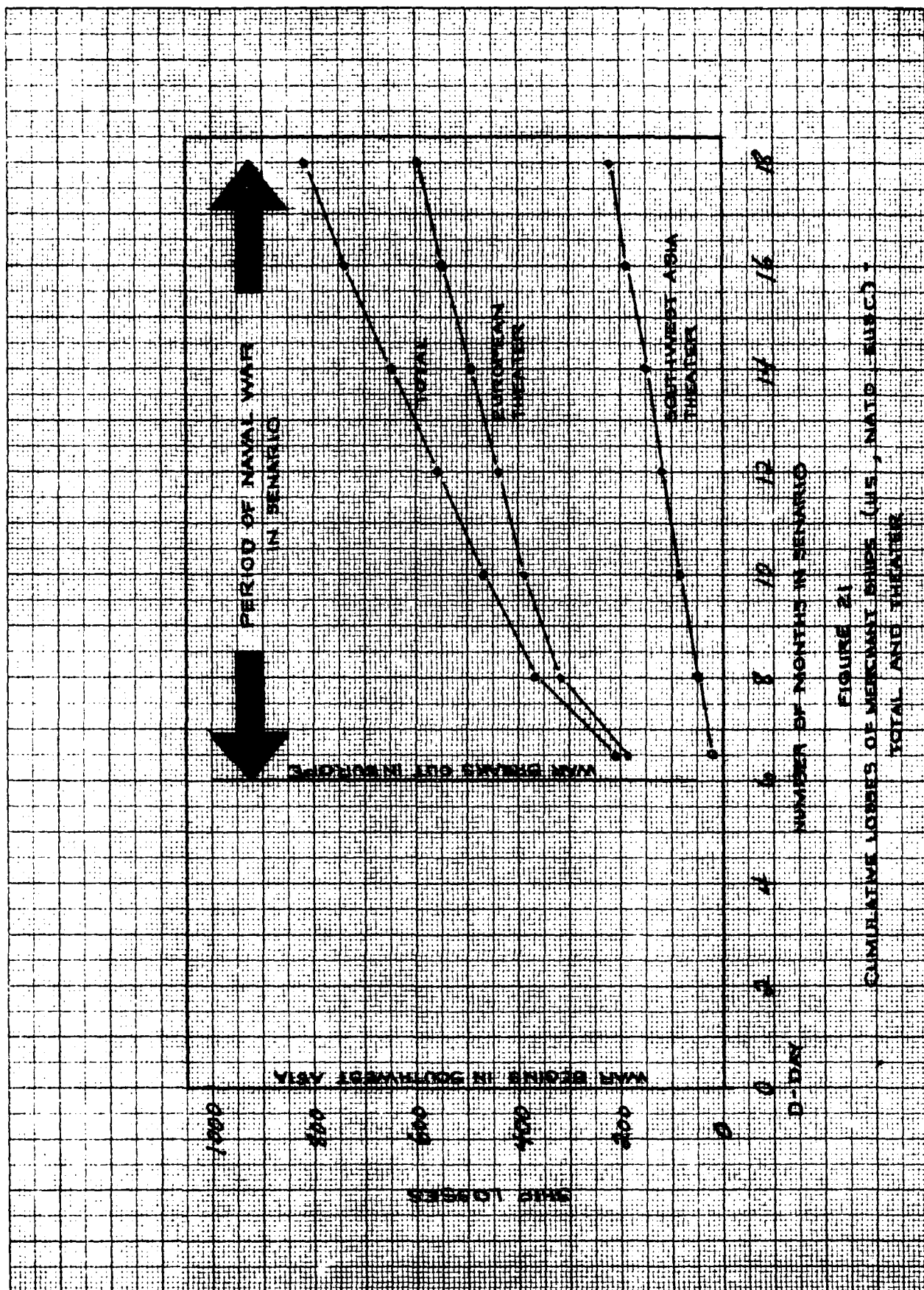
Ship-type	Theater	
	Southwest Asia	Europe
RO-RO ship	(1)	96
Self-sustaining containership	47	(1)
Nonself-sustaining containership	(1)	158
LASH	(2)	(2)
SEABEE	(2)	(2)
Break-bulk ship	104	119
Tankship	73	226
Subtotal	224	599
Total	823	

Notes: (1) ship-type not used in this theater
(2) because of limited number, ship-type not included in attrition analysis

Attrition of RO-RO ships seriously hampers our replacement of unit equipment losses. During the first six months of the naval war, 68 RO-RO ships are lost. As a result, only 65 percent of the unit equipment losses are replaced using this ship-type. Hence, 35 percent of the replacement unit equipment must go by break-bulk ships with the associated delay due to increased handling time and slow ship speed. By the end of the war, 86 RO-RO ships are lost. This is 78 percent of the total RO-RO ships available.

At D plus 26, 35 NATO self-sustaining containerships are made available to sustain US armed forces in Southwest Asia. Note that only self-sustaining containerships are used in this theater. This increased

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the total number to 118. Of this number, 26 are lost by the end of the first six months of the naval war. A total of 47 self-sustaining containerships are lost during the war. These losses cause recurring shortfalls of resupply to the Southwest Asia theater.

The loss of 158 nonself-sustaining containerships during the war reduces the number of available ships of this type by 70 percent. However, sufficient ships remain to sustain our forces in Europe with the required resupply.

Almost equal numbers of break-bulk ships are lost while sustaining US armed forces in both the Southwest Asia and European theaters. In all, 38 percent of the available break-bulk ships are sunk. Even with this loss, we can sustain our armed forces with the required amounts of ammunition. US ship losses in the Southwest Asia theater are made up from the NDRF starting at D plus 37 and continuing through the war. Break-bulk ship losses in the European theater are made up with additional ships previously committed by European-NATO countries.

More tankships were required to sustain our forces than any other ship-type. This is reflected by the high number of tankship sinkings - a total of 299 in both theaters, or 65 percent of those available. At D plus 34, or two months into the naval war, we encounter problems sustaining our armed forces with POL in both theaters. These problems steadily get worse. In the Southwest Asia theater, the delivery of POL drops to 86 percent of the requirement at the sixth month of the naval war, and to 65 percent by the end of the war. Likewise, in the European theater the percentages are 48 and 37 respectively.

We have ignored the availability of replacement ships for this study since a significant number of merchant ships could not be built during the 18 months covered by the scenario.

CHAPTER VII

ENDNOTES

1. Vincent Esposito, BG, A Concise History of World War II, p. 403.
2. Samuel E. Morison, The Battle of the Atlantic, p. 411.
3. Terry Hughes and John Costello, The Battle of the Atlantic, p. 304.
4. Peter Colvocoressi, Top Secret Ultra, p. 91.
5. "A Conversation With Admiral Kidd," Sea Power, May 1981, p. 41.
6. Ted Crimral, MAJ, "Transportation Emergency Preparedness — Are We Ready?" Defense Transportation Journal, p. 79.
7. Association of the United States Army, Strategic Mobility: Can We Get There from Here — in Time?, p. 13.
8. Joint Chiefs of Staff, Logistics Directorate, Proceedings of the 1977 Worldwide Strategic Mobility Conference, p. II-C-11.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. We do not have sufficient RO-RO ships and self-sustaining containerships to sustain our armed forces in Southwest Asia.

2. We do not have sufficient RO-RO ships and tankships to sustain our armed forces in Europe if there is a moderate rate of attrition of these ships due to enemy attacks.

3. Today, we have sufficient merchant officers and seamen to crew the ships required to sustain our armed forces. However, the size of this workforce continues to decrease at an alarming rate.

4. The NDRF is a vital asset for our national security. Although a large portion of the fleet is WWII Victory ships, these ships can be activated in time to provide effective maritime logistical support to our armed forces.

5. The deployment time of US armed forces is seriously hampered by the shortage of available RO-RO ships and barge-ship systems.

6. Assuming a moderate attrition rate for merchant ships sustaining US armed forces, the shortage of tankships of the appropriate size is a potential "warstopper" in Europe.

7. When evaluating our sealift capability, attrition of merchant ships due to enemy attacks must be considered if the evaluation

is to be realistic.

8. Without a national maritime policy, the state of our merchant marine continues to deteriorate, dragging down with it our ability to deploy and sustain our armed forces.

Recommendations

1. The United States must set forth a national maritime policy that is consistent with this nation's interests and priorities. The policy must call attention to the fact that as an insular nation we cannot afford a declining merchant marine, that our peacetime shipping interests are not divorced from wartime interests, and that a strong merchant marine must be one of our highest national priorities.

2. In the near term, we should acquire sufficient RO-RO ships and self-sustaining containerships to ensure that we can deploy and sustain our armed forces during credible war scenarios. One approach should be to target trade routes that we could capture commercially in peacetime by operating these ship-types with generous federal subsidies. Then, we should build or otherwise acquire the ships to operate on these routes. An alternative approach is to acquire the ships for the NDRF, and place them in the RRF.

3. When studying credible war scenarios, logistical planners should consider the effects of attrition of merchant shipping on our sustainment capability.

4. In the long term, we should consolidate the "bits and pieces" of our maritime program, such as the various subsidies, SRP, NDRF and NTPS into a national strategy that complements our national maritime policy. This would permit civilian and military sectors to develop comprehensive strategies and ship-resources.

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